THE

AMERICAN NATURALIST.

VOL. XX.—*NOVEMBER*, 1886.—No. 11.

COMPARATIVE STUDIES UPON THE GLACIATION OF NORTH AMERICA, GREAT BRITAIN AND IRELAND.[1]

BY PROFESSOR H. CARVILL LEWIS.

OBSERVATIONS extending over several years upon glacial phenomena on both sides of the Atlantic had convinced the author of the essential identity of these phenomena; and the object of this paper was to show that the glacial deposits of Great Britain and Ireland, like those of America, may be interpreted most satisfactorily by considering them with reference to a series of great *terminal moraines*, which both define confluent lobes of ice, and often mark the line separating the glaciated from the non-glaciated areas.

The paper began with a sketch of recent investigations upon the glaciation of North America, with special reference to the significance of the terminal moraines discovered within the last few years. The principal characters of these moraines were given, and a map was exhibited showing the extent of the glaciated areas of North America, the course of the interlobate and terminal moraines, and the direction of striation and glacial movement. It was shown that apart from the great ice-sheet of Northeastern America, an immense lobe of ice descended from Alaska to Vancouver's island on the western side of the Rocky mountains, and that from various separate centers in the Cascade, Sierra Nevada and Rocky mountains there radiated smaller local glaciers.

The mountains encircling the depression of Hudson bay

[1] Abstract of a paper read at the Birmingham meeting of the British Association, September, 1886.

seemed to be the principal source of the glaciers which became confluent to form the great ice-sheet. In its advance this ice-sheet probably met and amalgamated with a number of already existing local glacial systems, and it was suggested that there was no necessity for assuming either an extraordinary thickness of ice at the pole or great and unequal elevations and depressions of land.

Detailed studies made by the author in Ireland, in 1885, had shown remarkably similar glacial phenomena.

The large ice-sheet which covered the greater part of Ireland was composed of confluent glaciers, while distinct and local glacial systems occurred in the non-glaciated area. The principal ice-sheet resembled that of America in having for its center a great inland depression surrounded by a rim of mountains.

These appear to have given rise to the first glaciers, which after uniting poured outwards in all directions. Great lobes from this ice-sheet flowed westward out of the Shannon and out of Galway, Clew, Sligo and Donegal bays, northward out of Loughs Swilly and Foyle, and south-eastward out of Dundalk and Dublin bays, while to the south the ice-sheet abutted against the Mullaghareirk, Galty and Wicklow mountains or died out in the plains.

Whether it stopped among the mountains or in the lowlands its edge was approximately outlined by unusual accumulations of drift and boulders, representing the terminal moraines. As in America, this outer moraine was least distinct in the lowlands, and was often bordered by an outer fringe of drift several miles in width.

South of an east and west line extending from Tralee to Wexword is a non-glaciated zone free from drift. Several local systems of glaciers occur in the south of Ireland, of which by far the most important is that radiating from the Killarney mountains, covering an area of 2000 square miles, and entitled to be called a local ice-sheet. Great glaciers from this Killarney ice-sheet flowed out of the fiord-like parallel bays which indent the south-western coast of Ireland. At the same time the Dingle mountains, the Knockmeal down and Comeragh mountains, and those of Wexford and Wicklow, furnished small separate glaciers, each sharply defined by its own moraine.

No evidence of any great marine submergence was discovered, although the author had explored the greater part of Ireland, and

the eskers were held to be phenomena due to the melting of the ice and the circulation of subglacial waters. The Irish ice-sheet seemed to have been joined at its north-eastern corner by ice coming from Scotland across the North channel. All the evidence collected indicates that a mass of Scotch ice, reinforced by that of Ireland and England, filled the Irish sea, overriding the Isle of Man and Anglesey, and extending at least as far south as Bray Head, south of Dublin. A map of the glaciation of Ireland was exhibited in which the observations of the Irish geologists and of the author were combined, in which was shown the central sheet, the five local glacial systems, all the known striæ, and the probable lines of movement as indicated by moraines, striæ and the transport of erratics.

The glaciation of Wales was then considered. Wales was shown to have supported three distinct and disconnected local systems of glaciers, while at the same time its extreme northern border was touched by the great ice-lobe of the Irish sea. The most extensive local glaciers were those radiating from the Snowden and Arenig region, while another set of glaciers radiated from the Plinlimmon district and the mountains of Cardiganshire, and a third system originated among the Brenockshire beacons. The glaciers from each of these centers transported purely local boulders and formed well-defined terminal moraines. The northern ice-lobe, bearing granite boulders from Scotland and shells and flints from the bed of the Irish sea, invaded the northern coast but did not mingle with the Welsh glaciers. It smothered Anglesey and part of Carnarvonshire on the one side, and part of Flintshire on the other, and heaped up a terminal moraine on the outer flanks of the North Welsh mountains. This great moraine, filled with far-traveled northern erratics, is heaped up in hummocks and irregular ridges, and is in many places as characteristically developed as anywhere in America. It has none of the characters of a sea-beach, although often containing broken shells brought from the Irish sea. It may be followed from the extreme end of the Lleyn peninsula (where it is full of Scotch granite erratics) in a north-easterly direction through Carnarvonshire past Moel Tryfan and along the foot of the mountains east of Menai strait to Bangor, where it goes out to sea, reappearing further east at Conway and Colwyn. It turns south-eastward at Denbigshire, going past St. Asaph and Halkin mountain. In Flintshire it

turns southward and is magnificently developed on the eastern side of the mountains, at an elevation of over 1000 feet between Minera and Llangollen, south-west of which place it enters England. There is evidence that where the ice-sheet abutted against Wales it was about 1350 feet in thickness. This is analogous to the thickness of the ice-sheet in Pennsylvania, where the author had previously shown that it was about 1000 feet in thickness at its extreme edge and 2000 feet thick at points some eight miles back from its edge. The transport of erratics coincides with the direction of striæ in Wales as elsewhere, and is at right angles to the terminal moraines.

The complicated phenomena of the glaciation of England, the subject of a voluminous literature and discordant views, had been of high interest to the author, and had led him to redouble his efforts toward its solution. He had found that it was possible to accurately map the glaciated areas, to separate the deposits made by land ice from those due to icebergs or to torrential rivers, and to trace out a series of terminal moraines, both at the edge of the ice-sheet and at the edge of its confluent lobes. Perhaps the finest exhibition of a terminal moraine in England is in the vicinity of Ellesmere, in Shropshire. A great mass of drift several miles in width and full of erratics from Scotland and from Wales, is here heaped into conical hills which enclose "kettle holes" and lakes, and have all the characters of the "kettle moraines" of Wisconsin, Like the latter, the Ellesmere moraine here divides two great lobes of ice, one coming from Scotland the other from Wales. This moraine may be traced continuously from Ellesmere eastward through Hadeley, Macclesfield, to and along the western flank of the Pennine chain, marking throughout the southern edge of the ice-sheet of Northern England. From Macclesfield the same moraine was traced northward past Stockport and Staley bridge to Burnley and thence to Skipton in Yorkshire. Northeast of Burnley it is banked against the Boulsworth hills up to a height of 1300 feet in the form of mounds and hummocks. South and east of this long moraine no signs of glaciation were discovered, while north and west of it there is every evidence of a continuous ice-sheet covering land and sea alike. The striæ and the transport of boulders agree in proving a southerly and south-easterly direction of ice-movement in Lancashire and Cheshire.

From Skipton northward the phenomena are more complicated. A tongue of ice surmounted the watershed near Skipton and protruded down the valley of the Aire as far as Bingley, where its terminal moraine is thrown across the valley like a great dam, reminding one of similar moraine dams in several Pennsylvania valleys. A continuous moraine was traced around this Aire glacier. Another great glacier, much larger than this, descended Wensleydale and reached the plain of York. The most complex glacial movements in England occurred in the mountain region about the Nine Standards, where local glaciers met and were overpowered by the greater ice-sheet coming down from Cumberland. The ice-sheet itself was here divided, one portion going southward, the other, in company with local glaciers and laden with the well-known boulders of the "Shap granite," being forced eastward across Stainmoor forest into Durham and Yorkshire, finally reaching the North sea at the mouth of the Tees. The terminal moraine runs eastward through Kirby Ravensworth toward Whitby, keeping north of the Cleveland hills, and all Eastern England and south of Whitby appears to be non-glaciated. On the other hand all England north of Stainmoor forest and the river Tees, except the very highest points, was smothered in a sea of solid ice.

There is abundant evidence to prove that the ice-lobe filling the Irish sea was thicker towards its axis than at its edges, and at the north than at its southern terminus, and that it was reinforced by smaller tributary ice-streams from both England and Ireland. It may be compared with the glacier of the Hudson River valley in New York, each having a maximum thickness of something more than 3000 feet. The erosive power of the ice-sheet was found to be extremely slight at its edge but more powerful farther north, where its action was continued for a longer period. Towards its edge its function was to fill up inequalities rather than to level them down. It was held that most glacial lakes are due to an irregular dumping of drift rather than to any scooping action. Observations in England and Switzerland coinciding with those in America to confirm this conclusion. Numerous facts on both sides of the Atlantic indicate that the upper portion of the ice-sheet may move in a different direction from its lower portion. It was also shown that a glacier in its advance had the power of raising stones from the bottom to the

top of the ice, a fact due to the retardation by friction of its lower layers. The author had observed the gradual upward passage of sand and stones in the Grindenwald glacier, and applied the same explanation to the broken shells and flint raised from the bed of the Irish sea to the top of Moel Tryfan, to Macclesfield and to Dublin mountains.

The occurrence of stratified deposits in connection with undoubted moraines was shown to be a common phenomenon, and instances of stratified moraines in Switzerland, Italy, America and Wales were given. The stratification is due to waters derived from the melting ice, and is not proof of submergence.

It was held that, notwithstanding a general opinion to the contrary, there is no evidence in Great Britain of any marine submergence greater than about 450 feet. It was expected that an ice-sheet advancing across a sea should deposit shell fragments in its terminal moraine.

The broad principle was enunciated that wherever in Great Britain marine shells occur in glacial deposits at high levels, it can be proved both by striæ and the transport of erratics that the ice advanced on to the land from out of the sea. The shells on Three Rock mountain, near Dublin, and in North Wales and Macclesfield, all from the Irish sea, the shells in Cumberland transported from Solway Firth, those on the coast of Northumberland brought out of the North sea, those at Airdree, in Scotland, carried eastward from the bottom of the Clyde, and those in Caithness from Moray firth, were among examples adduced in proof of this principle. The improbability of a great submergence not leaving corresponding deposits in other parts of England was dwelt upon.

It was also held that there was insufficient evidence of more than one advance in the ice-sheet, although halts occurred in its retreat. The idea of successive elevations and submergence with advances and retreats of the ice was disputed, and the author held that much of the supposed interglacial drift was due to subglacial water from the melting ice.

The last portion of the paper discussed the distribution of boulders, gravels and clays south of the glacial area. Much the greater part of England was believed to have been uncovered by land ice. The drift deposits in this area were shown to be the result in part of marine currents bearing icebergs during a sub-

mergence of some 450 feet. The supposed glacial drift about Birmingham and the concentration of boulders at Wolverhampton were regarded as due to the former agent, while the deposits at Cromer and the distribution of Lincolnshire chalk across Southern England was due to the latter. The supposed esker at Hunstanton was held to be simply a sea-beach, and the London drift deposits to be of aqueous origin. Thus the rival theories of floating icebergs and of land glaciers were both true, the one for Middle and Southern England, the other for Scotland, Wales and the north of England; and the line of demarkation was fixed by great terminal moraines.

The paper closed with an acknowledgment of indebtedness to the many geologists of England and Ireland who had uniformly rendered most generous assistance during the above investigation.

——:o:——

SOME PECULIARITIES OF THE LOCAL DRIFT OF THE ROCKY MOUNTAINS.[1]

BY DR. THEO. B. COMSTOCK.

ALL authorities upon the subject of the glacial deposits of the Rocky Mountain region agree in describing them as local or much restricted in extent. Some writers dismiss the matter with this remark, leaving it to be inferred that in other respects the character of the drift is quite similar to the well-known débris of the Eastern United States. Others have been more explicit and have shown how special conditions of topography have affected the accumulations in certain localities. In all cases where the details have been given the evidence is strong of excessive erosion, but almost invariably the transportative effects have been remarkably slight. As a natural result we meet with much variety in the gulches and gorges which can be traced to such an origin, while the diluvium of the subsequent melting period is made up of homogeneous materials in each instance, but wholly of local detritus. This gives to many of the unmodified morainal deposits a resemblance to alluvium which is quite striking. On the other hand, in some places (as notably near the head of Wind river, Wyoming) iceberg deposits are well simulated by the collections of boulders which have evidently rolled down the steep

[1] Paper read before the A. A. A. S., Section E, Buffalo, 1886.

slopes left in side-gulches by the retreat of the diminutive glaciers. Existing glaciers in the Wind River mountains and in the San Juan mountains (S. W. Colorado), enable us to witness the actual production of some of these peculiar effects and to understand more clearly how *defragation*[1] has played a very important part in the rough chiseling of mountain features in the far West.

The general southward trend of the glacier-cut cañons is very marked, although numerous side-gulches follow more or less transverse courses. In Northern Wyoming, at the close of the Glacial Period, the old Tertiary lake basins were still in condition to receive and assort the material deposited by the melting ice, and the greater part of the drainage was easy; but in some cases in the interior of the mountain masses to the northward, narrow, elongated basins were ploughed out below the general drainage, although very few of these now exist in which an outlet has not since been made. In the heart of the Wind River mountains a remarkable structure of this kind is to be seen nearly opposite old Camp Brown, at the head of the North fork of the Popo-agie river, near the base of Fremont's peak. Here two of these deep, narrow cañons run parallelwise for several miles, with small glaciers still acting upon their shaded sides, the drainage from one being to the Missouri tributaries, the other feeding affluents of the Colorado drainage. In Southern Colorado somewhat similar features are apparent, but the excessive folding and faulting of the strata have very much complicated matters, so that the results are rather unique. The same type, modified by lithological and structural conditions, may be observed in the Gunnison region and about the sources of the Snake and Yellowstone rivers in Wyoming, but the special San Juan features are not repeated exactly in any other district so far as my observation goes. The distinctive peculiarity lies in the duplex character of the erosion; that is to say, there are two zones of glaciation vertically, the upper largely representing the transportative action, the lower being eroded without removal of the débris to any great extent. The imperfect drainage had fastened the ice-sheet so that it could move as a unit only in the superficial portion, while the lower part acted like a slowly work-

[1] I propose this term to express the breaking or tearing down of masses of rock from the walls of gorges, as distinguished from the ordinary abrading or grinding action of the glacier.

ing plough, which cut deeply but not so extensively as the overriding mass. In the more elevated tracts, therefore, the lower portion often lay in grooves like *culs-de-sac*, and many of these exist to-day, connected with the main channels often by reversed or indirect drainage. The *lower limit of exportation*, which defines the line of junction of the two layers, follows nearly the contour of 11,000 feet above sea-level (varying from 10,500 feet to 11,500 feet). The side-gulches, except where eroded by more recent aqueous action, commonly join the main cañons on this grade. The "timber-line" is fairly continuous with these *debouchures*, and I am satisfied that this feature has been largely instrumental in determining that sharp line of demarkation. Undoubtedly the melting of the ice in the cañons left many side-glaciers discharging by "ice-falls" over the walls for a long time afterwards, the vegetation growing up to this limit, because the land-locked cañons were for a period filled with water which arranged more or less of soil along the sides of the channels. This fact is clearly proven by the occurrence of terraces, in such lacustrine material, up to a height of 1000 feet above the present stream beds in places. The positions of scattered boulders in the cañons, and of those imbedded in the deposits along the walls afford further evidence of the local transportation of material by floating masses of ice, which dropped their burdens upon melting.

The drift of the Rocky mountains thus possesses peculiar interest, corroborating the notion of its intimate relation to the glacial deposits of the east, and yet exhibiting a variety in detail which may aid materially in unraveling obscure points in the history of other areas with weak development of the same conditions. The local character of the effects has prevented many from appreciating the really gigantic erosion and deposition which have taken place.

——:o:——

THE MAMMARY GLAND OF THE ELEPHANT.

BY SPENCER TROTTER, M.D.

IN studying any particular animal form we are wont to refer to some other well-known type as a basis for comparison, and in this way gain an idea of the animal's place in life, its relations to the environment and to the other beings among which it lives. As our studies extend and we become more widely acquainted with

the many diverse forms, we quickly note any departure on the part of an organ from its usual form or position, and are thus led directly to enquire into the cause or causes which brought about the change. In those mammals whose habit it is to suckle their young standing, namely, the Ungulata, any one who has given the least thought to the subject is aware that their mammary glands are situated at the posterior part of the ventral line, *i. e.*, in the inguinal region, or groin. A striking exception to this is seen in the elephant, where these glands are located anteriorly, in the pectoro-axillary spaces.

The elephant holds a unique position in nature, representing the last of a long ancestral line which attained its maximum development in the Tertiary. Its immediate progenitor most likely occupied the southern range, thus escaping extinction in the drift and glacial epochs, and carrying down to present times this highly interesting and peculiar form. With no relatives extant, the elephant forms a separate and distinct order, the Proboscidia, but curiously enough possessing characters which ally it with the widely different Rodentia; it is herbivorous, and in general habit and mode of life is an ungulate, in a portion of which order it was usually assigned a place in the older nomenclature.

It is as an ungulate or "hoofed animal," therefore, that the elephant interests us, and from the fact that like all the species of that order the female is in the habit of suckling her young in the standing posture we are led to ask ourselves the reason for the striking exception in the position of the mammary glands. It will be understood that I refer to animals which give birth as a rule to one, or at most two offspring at a time, and which consequently have the minimum number of glands, not to those which "litter" like the hog family and present a series of glands running along each side of the belly line.

In dealing with a subject of this nature we enter one of those broad fields of philosophic science whose farther boundary, if indeed it have any, lies far below our mental horizon. The rock-imbedded bone of the palæontologist, which elsewhere bears such useful testimony, is comparatively of little value, and even the profounder facts of embryology fail to tell us why such striking differences occur, and what brought them about. It is a subject involving the underlying principles of tissue metamor-

phosis and nutrition in their broadest sense; a study vague enough in the present, but rendered far more so by the lapse of time. Action and reaction between organism and environment; the demands of increasing functional activity upon plastic tissue, and the effects of *use* and *disuse*, these are the fundamental principles involved, and we can only surmise at the primitive condition of affairs from the few tangible points presented to us. By attention to the following facts we may be able to gain a few ideas which will possibly throw some light upon the subject. At the anterior end of the great arterial trunk (*aorta*) two branches arise (*subclavian*) which proceed to the fore limbs. These, in turn, give off each a branch (*internal mammary*) which passes downward and backward along the anterior thoracic wall. At the posterior end of this great trunk two other branches arise (*iliac*), proceeding to the hind limbs, these also giving off each an artery (*superficial epigastric*) which runs forward in the abdominal wall to anastomose with the terminal branches of the internal mammary, thus forming an arc on each side of the ventral median line from neck to groin. This we will call the *mammary arc*. Now it is evident that in those mammals whose glands are situated solely in the pectoral region, as in Primates, Chiroptera, elephant, etc., the internal mammary artery is the main supply of the gland; while in those in which the structure is inguinal, as in the horse, deer, etc., the superficial epigastric is the main blood feeder.

Again, when the glands are situated in a row along the under surface of the body, as in Carnivora, Suidæ, etc., the entire *arc* of blood-vessels comes into play as a source of supply. We have every reason to believe that this latter state of affairs was the original arrangement of the parts, as the lowest and most ancient forms now extant present this same condition correlated with plurality of young at a birth, which is also undoubtedly a primitive condition. As specialization proceeded a reduction in the number of young at a birth followed, and consequently fewer glands were used; those only which were the most convenient to the young animal, while the rest atrophied and finally disappeared from want of use. Whether the prototype of the Proboscidians was large or small, whether it produced a number of young at a single birth, and consequently possessed a series of glands running along the belly, or what its habits were we cannot

say; but the possibility of such a condition having existed can no more be denied than it can be proved, and we have good reasons in believing such to have been the case. We know the rodents to be a very ancient group, and if the ancestor of the Proboscidian was allied to them in any way it, in all probability, presented many points of affinity in structure and habits.

If we take the foregoing in a hypothetical sense, supposing the ancestral form to have given birth to a number of young at one time, and to have possessed a corresponding number of glands, we have yet to answer the question: Why should the elephant, after specialization and reduction, present pectoral instead of inguinal glands?

The hog family, Suidæ, while not a primitive form of ungulate, still retain many ancestral characters, among them plurality of young and gland structure, and we have every reason to believe that the entire order sprang from a similarly low form; yet they all, after specialization and reduction, present inguinal glands.

There may have been many causes which will never occur to us why the young Proboscidian should use the anterior pair of glands; but two of them have occurred to me as a feasible, if not in our present state of knowledge, a satisfactory explanation.

Any one whose eye is accustomed to take in the animal form will have noticed that in the majority of hoofed animals the belly line slopes upward and backward; take the horse, deer, ox, camel, or any of the large herbivores for example. Now the reverse is true of the elephant, the belly line sloping downward and backward, this being in part due to the large pendulous genitals in the female, and in part to the tremendous abdominal viscera bagging down and occupying a rather short space lengthwise in proportion to the animal's general build. The young elephant, sucking as it does with its mouth, and possessing a short and comparatively immobile neck, would find it very inconvenient if the glands were situated in the inguinal region with the massive knees of the mother in the way; and this difficulty would be still more increased as the young animal grew. As it is, the nipple projects horizontally from the pectoral region, the most convenient point, with nothing to interfere; and as the early prototype became more and more specialized, the fewer, and finally the single offspring resulting used this most convenient gland to the exclusion of the others, which have disappeared from want of

use in the long lapse of time before the Proboscidian became such.

Very different is the case with the arched, cleanly-cut inguinal space of the female ungulate, and its long, flexible-necked offspring, where the mammary gland is carried so easily by the mother, and is so accessible to the young. Here the anterior glands are the ones that have been discarded.

These are mere speculations, for what can we do with such a subject? Surely not discard it altogether! Far better attempt even in the roughest way to interpret with what little light we have from the past, and fall wide the mark in our conclusions, than to pass unnoticed one fragment in the great history of life.

——:o:——

IS LITTORINA LITOREA INTRODUCED OR INDIGENOUS?

BY W. F. GANONG.

IT is now nearly thirty years since *Littorina litorea* (Linn.), the English periwinkle, was first reported from American waters, but the question as to whether it has been recently introduced or was an original inhabitant of our shores is still unsettled. This mollusk, though not known by naturalists to occur upon the coast of Acadia and New England previous to its discovery at Halifax in 1857 by John Willis, is at present very abundant from the Gulf of St. Lawrence to Connecticut.

Professor Verrill (Amer. Jour. Sci., iii, IV, p. 133, 1874) says of it: "It has been supposed by several writers that this shell (*L. litorea*) has been recently and accidentally introduced from Europe; but Dr. Dawson informs me that he collected it more than thirty years ago in the Gulf of St. Lawrence. It is abundant at Halifax, and we have other specimens from Kennebunkport, Me., Hampton Beach, N. H., and Provincetown, Mass. There is really no sufficient evidence that it was not an inhabitant of our shores before the advent of Europeans, but local in its habitats. It may have become more diffused in recent times by commerce, or it may have been overlooked formerly by collectors."

The causes determining the geographical distribution of animal and plant life are a subject of the greatest importance to naturalists, and any contribution to it has its value. So peculiar and

interesting are the known facts in regard to the distribution and spread in America of the shell we are considering, that an inquiry into the nature of these facts, and a search for an explanation for them becomes a matter of more than special importance. The value of the settlement of the question as to whether *Littorina litorea* has been introduced in recent times or is a native of America, is not limited to the settlement of this fact only. It has a broader value as well, inasmuch as it has a bearing upon the science of the distribution of animals.

It must be remembered that no species of animal or plant can, in the strict sense of the word, be indigenous to both Europe and America. If such were the case it would be necessary to suppose that the two independent lines of descent, either from a common near or remote ancestor, culminating in the species, had followed precisely identical courses of development. The latter would require precisely identical conditions of environment—and such we know would not exist upon two separate continents. Hence a shell which is common to two continents must in some way have been introduced from one to another. It may be introduced by the agency of man, or by purely natural and physical causes, such as ocean currents, etc. For want of a better term the word *indigenous* has been used in the present paper to apply to a species introduced in past time by *natural* agencies and now thoroughly established as a resident.

Such a species is our so-called "native periwinkle," *Littorina palliata* (Say). It is common to Europe, Greenland and America, and has existed for a long time in all three countries, being found fossil in the Post-pliocene of all of them. It will be presently shown that this shell was probably introduced from the continent in which it *originated* to the other by way of Greenland and Iceland, and by strictly natural agencies. We therefore speak of it as indigenous to America, though whether its descent from its parent species took place here or in Europe we are unable to say. But we hope to be able to show that *Littorina litorea* did not exist in America until introduced from Europe by man, and that since the beginning of the present century.

Mr. John Willis, who was the first to announce its discovery in America (Trans. Nova Scotia Inst. Nat. Sci., Vol. 1), found it at Halifax in 1857. He considered it to be indigenous to Nova Scotia chiefly for the reason that "some of the oldest inhabitants

have assured me that they have 'often picked the periwinkle, the same as the English one,' on the shores contiguous to Halifax when they were only school-boys."

The only other evidence that has been found to show that the shell was known in Nova Scotia, previous to 1857, comes in a private letter to the writer from Mr. E. Gilpin, of Halifax. He says: "Historical evidence in the shape of old English settlers shows it to have been known in the province as far back as 1800."

How much reliance can be placed upon the unscientific evidence of old settlers is a question; but granting that they did not confound it with the native form, and that they actually saw it previous to 1857, nothing more is proved than that the shell existed in Nova Scotia some years before Willis found it. Similarly it may be said of the fact that Dr. Dawson "collected it more than thirty years ago in the Gulf of St. Lawrence," that it proves (if granted) only that the shell was to be found there earlier than any published record shows. Or it may be that, if introduced, it was introduced at more than one point.

It is somewhat remarkable, however, that, as will be shown farther on, no other collector found this conspicuous shell in the gulf until after 1870, although Dr. Dawson must have found it at least as early as 1844. We know that it increases with great rapidity wherever introduced. Why then, if it existed there, did it not increase sufficiently to enable some other collector to find it? None of the lists of Bell, Whiteaves or Dr. Dawson himself mention it until after 1870. It is to be regretted that we have not some record of Dr. Dawson's discovery of the shell so far back, besides the note by Professor Verrill who doubtless writes from memory.

If this shell be indigenous to our shores, it must have been confined, previous to say 1850, exclusively to the Nova Scotia coast. That this must be so is shown as well by other facts as by the many lists we have of New England and Gulf of St. Lawrence shells, all of which mention the native periwinkles, *L. palliata*, *L. rudis*,[1] *L. tenebrosa*,[1] while *L. litorea* never appears. That the latter could have been present but "overlooked by collectors" is altogether out of the question. It is a much larger and more conspicuous shell than the native forms, has the same habitats, and wherever it occurs at all occurs abundantly.

[1] For convenience we will consider these two to be distinct species, although they are probably varieties of the same species.

Among the many lists of New England shells which might be named, the following have been selected:

Gould's "Invertebrata of Mass.," 1st ed. (1841), mentions *L. palliata*, *rudis* and *tenebrosa* but not *litorea*.

Mighel's list of the shells of Maine[1] (1843) mentions *L. palliata*, *rudis* and *tenebrosa* as occurring "in the greatest profusion," but *L. litorea* is not in the list.

Reed's "Catalogue of the Shells of Mass."[2] (1845) mentions the same three but not *litorea*.

Russell's "Retrospect of some of the Shells found in Essex county, Mass."[3] (1851), mentions the same three but not *litorea*.

Tuft's "List of Shells collected at Swampscott Lynn and vicinity" (1853) mentions the same three as abundant, but not *litorea*.

Stimpson's "List of the marine Invertebrates of Grand Manan" (1854) mentions *L. palliata* (= *L. littoralis*) and *L. rudis*, but not *L. litorea*.

Tuft's "Catalogue of Shells in the State cabinet [of Mass.]" (1859) mentions the same three but not *litorea*.

Nor has it been reported until quite recently from the Gulf of St. Lawrence.

Dr. Dawson's "A week in Gaspé"[4] (1858) mentions *L. rudis* and *L. palliata*, but not *L. litorea*. If Dr. Dawson found it in the Gulf of Lawrence "thirty years ago," it must have been at some other point.

Robert Bell's "List of the Mollusca of Eastern Canada"[5] (1859) mentions *L. palliata* only.

J. F. Whiteaves' "On the marine Mollusca of Eastern Canada"[6] (1869) mentions *L. palliata* (*littoralis*), *L. rudis* and *L. tenebrosa*, but not *L. litorea*.

Although the evidence of these lists is only negative, their combined force is so strong (even had we no other evidence) that they practically prove that the shell did not exist upon the New England coast, and probably not in the Gulf of St. Lawrence, previous to the middle of the present century. Since 1857 its spread has been phenomenally rapid. A paper, by A. F. Gray, in Science News for 1879, gives many localities which it had come to inhabit upon the New England coast, and the known facts of its spread are thus summarized by Professor Verrill:[7]

"It is well known to American conchologists that this common European species has become well established upon the New England coast within ten or twelve years, appearing first upon

[1] Boston Jour. Nat. Hist., IV.

[2] See for this as well as other lists, Binney's "Bibliography of American Conchology," Smithsonian, Vol. I.

[3] Jour. Essex county Nat. Hist. Soc., I.

[4] Can. Nat., III, 321.

[5] Can. Nat., IV, 197.

[6] Can. Nat., ii, IV. 48. See also Can. Nat., ii, IV, 270.

[7] Am. Jour. Sci., iii, XX, 251.

the coast of Maine about 1868; Dr. Dawson, however, states that he collected it on the shores of Nova Scotia at a much earlier date. I wish at present merely to put on record some additional data as to its recent progress along the coast. In 1873 it was collected in abundance at Saco, Maine, by the U. S. Fish Commission, and was found sparingly at Peake's island, Casco bay. In 1872 it was very rare at Provincetown, Mass., but in 1875 it was common there. In 1875 it was collected by the writer at Barnstable, Mass., on the shores of Cape Cod bay, in large quantities. In 1879 it had become exceedingly abundant at Provincetown. In 1875 our parties found two specimens only on the southern shores of Cape Cod, at Wood's Holl, but in 1876 it was found to be common there, and is now very abundant. The first specimen found so far westward as New Haven was obtained by Professor S. I. Smith during the past winter ['79–80]. Other solitary specimens have since been obtained here by E. A. Andrews and by J. H. Emerton. It is at present exceedingly abundant at Newport, R. I."

It is spreading into the Gulf of St. Lawrence, too, finding probably a congenial habitat in the warmer water of Northumberland straits, which contain so many southern forms. J. F. Whiteaves found it at Souris and Charlottetown, P. E. I., in 1873.[1]

Do not these facts afford an exceedingly strong argument that the shell has been introduced? Its rapid increase southward shows that a favorable habitat was there waiting for it—a much more favorable one than the Nova Scotia coast. The conditions which determine its spread were here at work a century ago, but it was not found anywhere in New England.

As has already been pointed out, no species of animal or plant can be truly indigenous to the two continents. It must either have originated in one and spread to the other, or it must have originated at some other point and spread to both. A shell such as we are considering, which is at present common to both continents must either have been introduced from one to the other by man's agency, or by purely natural means. If it can be shown that the natural means did not operate in this case, it would prove that man must have introduced it; and the stronger the probability of the former, the stronger will be that of the latter.

Winds or the agency of birds, so active in the distribution of plants, could hardly operate upon a shell or its young. Ocean currents seem to be the only method of conveyance. But by no means could either *L. litorea* or *L. palliata* directly cross the At-

[1] Report on deep-sea dredging operations in the Gulf of St. Lawrence.

lantic in such a way—they must have come, if they came by natural means at all, by way of Iceland, Greenland and Labrador.

This we find actually was the case with *L. palliata.* Where it originated the writer does not know, nor does it matter in the present connection, but certain it is that it is now common to England,[1] Greenland,[2] Labrador,[3] Acadia and New England. And not only does it exist in these places now, but it has for a long time past, for it is found fossil in Post-pliocene deposits in England, in Southern Greenland[3] (*L. grönlandica* = *L. palliata*) and in Canada, though not actually in Acadia. Dawson reports it from the Post-pliocene of Gaspé,[4] and Lyell from Beauport.[5] We may hence conclude that *L. palliata* is, in the sense in which we have used the word, indigenous to America.

But as to *L. litorea,* not only does the latest and best list of Greenland shells[2] make no mention of its occurrence there, nor does Packard in a list of the shells of Labrador[3] (though he mentions *L. palliata* and *L. rudis* as "abundant" and "not uncommon"), but no trace of it has as yet been reported from any Post-pliocene deposits of Greenland, Labrador, Canada or New England. It is a shell much more likely to be preserved in such deposits than *L. palliata,* being much larger and stouter—though neither, from their rock-loving nature, stand as much chance of being preserved as sand or mud-inhabiting species. All of these facts tend to show that *L. litorea* was not introduced from one continent to the other either at the same time or by the same means as *L. palliata,* and that if by any unknown agency whatsoever *L. litorea* had reached America, it must have been confined to Nova Scotia alone until the middle of the present century.

But we have another source of information about the shells which lived upon our coast before the advent of the Europeans. In the Indian shell-heaps along the coast of Maine and New Brunswick, most of the edible mollusks of the coast are found among the heaps of clam-shells. Dr. Wyman reports[6] that in a shell-heap at Crouch's cove, Casco bay, Maine, *Littorina palliata*

[1] Forbes and Hanley's British Mollusca, Vol. III.
[2] Manual and instructions for the Arctic expedition. London, 1876.
[3] Packard, Mem. Bost. Nat. Hist. Soc., Vol. I.
[4] Can. Nat., II, 408.
[5] Can. Nat., I, 345.
[6] AM. NAT., Vol. I, No. II, 1868.

was found along with such species as *Purpura lapillus*, *Natica heros*, *Buccinum undatum*, *Nassa obsoleta*, *Nassa trivittata*, etc., but he makes no mention of *L. litorea*. Mr. G. F. Matthew, in his account[1] of investigations into an undisturbed shell-heap on the shore of Passamaquoddy bay, New Brunswick, after mentioning the occurrence of several littoral species, says: "The rock periwinkle (*Littorina rudis*) is occasionally found * * * but the common European periwinkle (*Littorina litorea*), now so common on this coast, is entirely wanting." In a private letter to the writer the same gentleman says: "I have seen no trace of *L. litorea* in any shell-heap." That the Indians would have collected the smaller native periwinkle and other small littoral species, and not the larger English one, were the latter present, is inconceivable, no matter whether the former had been collected for food or only accidentally introduced into the shell-heaps. The same causes should have introduced *L. litorea* if it had existed at these places. Again the conclusion is forced upon us that if the shell existed in America at the time of the formation of the shell-heaps, it must have been confined to Nova Scotia. We have no published lists of shells from the Nova Scotia shell-heaps, nor has the writer been able to find by private inquiry any satisfactory account of them.

All of the facts that we have so far mentioned in connection with this shell show that if it existed at all in America previous to the present century, it must have been confined to the coast of Nova Scotia. There are other general considerations which show that in all probability it did not exist there. One of these we have already mentioned—the fact that it was not introduced in the same way as *L. palliata*, by way of Greenland, and therefore was probably not naturally introduced into America at all.

Many undoubtedly European species of both animals and plant could be named which, upon their artificial or accidental introduction into this country, have driven out and well-nigh exterminated closely-allied native species. Everywhere upon the coast of Nova Scotia as well as that of the rest of Acadia and New England, *L. litorea* is doing precisely this, driving out the native *L. palliata*. Everywhere the native form gives way before it and becomes rare, just in proportion as the English form becomes abundant. This fact of itself gives us strong *a priori* grounds

[1] Bull. N. B. Nat. Hist. Soc., III, 1884.

for believing the shell to have been recently and accidentally introduced, but it acquires additional force taken in connection with other facts which point to the same conclusion.

But granting for a moment that the shell did exist in Nova Scotia previous to this century—where it must have been confined if it was in America at all—what an anomalous condition of life we have. At present, as we follow its progress southward, we find it growing more and more abundant. The writer has very frequently noticed its distribution on the Southern New Brunswick coast, but it there occurs in nothing like the profusion in which he has seen it at Nahant, Mass., or Newport, R. I. In these two places, and they are like other localities in these two States in this respect, it literally covers the rocks, the native species becoming comparatively rare. What is the meaning of the fact that it becomes more abundant southward? Can it mean anything else than that (within certain limits) as it goes south it meets with a more and more congenial habitat? If this be so, and we can see no other conclusion, it shows that *L. litorea* thrives better in warmer water than that of the coasts of Nova Scotia and New Brunswick, and therefore that the natural home of the species, or the place where it originated was in warmer water than that of Acadia. This conclusion is strengthened by the fact of its non-occurrence in Greenland or Labrador, to both of which places it should have been carried by the same agencies which took *L. palliata* there. The latter is certainly a more northern species than the former, and it may be that the conditions of life in tnese two places are altogether unsuited to the more southern *L. litorea*, in which case it could certainly not have been carried from one continent the other by way of Greenland. *If* then *L. litorea* existed upon the Nova Scotia coast as (in the sense in which we are using the word) an indigenous species, it was existing without spreading under comparatively unfavorable conditions of temperature, etc., while favorable conditions were waiting for it not far to the southward. Surely the agencies which took it from one continent to the other (if naturally introduced) could have carried it to the New England coast. Is it not more natural to suppose, what so many of the facts indicate, that the warmer waters in which it thrives the best are like those of its home, and that its home is in the waters of the English coast, which we know to be so much warmer than those of Nova Scotia?

But again, what is the meaning of its wonderfully rapid spread, and why, if it existed in Nova Scotia previous to say 1850, did it not begin to spread before? Its spreading as rapidly as it has, shows that it was only waiting for the opportunity to take advantage of it, but why, if it is indigenous, did it not begin to spread sooner? Surely the same causes which have carried it south since 1850 were in operation before. If they were natural, such as currents, etc., they certainly have been present substantially unchanged for centuries. Professor Verrill suggests that it may have existed formerly in Nova Scotia, but have "become more diffused in recent times by commerce." But surely there was commerce between Nova Scotia and New England before 1868 (in which year it was first reported from Maine), and enough of it to satisfy the most exacting demands of this theory. In all probability the rapid diffusion of the shell since 1857 is in a measure due to both of these causes, but the fact that they did not have a like effect before, seems very strongly to show that the shell was not in Nova Scotia for them to spread. The waters which bathe the Atlantic coast of Nova Scotia are carried by the strong Fundy tides across to the New Brunswick and Maine coasts, and if currents had anything to do with carrying *L. palliata* from one continent to Greenland and thence to the other, it should have carried the free-swimming embryos of its ally, *L. litorea*, from the Nova Scotia to the New England coast.

But granting again for a moment that *L. litorea* has existed in Nova Scotia for an indefinitely long time as an indigenous species, we have it existing under conditions very different from those in which it thrives in England, having, as has been shown, no connection with the latter, and yet retaining its specific identity. It is possible for a species to keep its identity in widely separated localities, where the conditions of life are not precisely the same, only by a continuous intercourse between the different localities. This is in all probability the case with *L. palliata*, for we find it ranging freely around the North Atlantic in England, Greenland,[1] Labrador, Acadia and New England, and the agencies which carried it from one land to the other have in all probability been in operation ever since. But with *L. litorea* the case is different; if it existed in Nova Scotia it must have been cut off from all communication with England, and that it should retain its

[1] We have found no list of the shells of Iceland.

specific identity under such conditions is altogether inconceivable.

We have not been able to present any *direct* proof that *L. litorea* did not exist in Nova Scotia before the present century. The testimony of the numerous lists (by independent observers, who could not have overlooked the shell had it been present) of shells on the coast of New England and New Brunswick in none of which occurs any mention of *L. litorea*, the testimony of its absence from the Post-pliocene deposits of other parts of Canada where *L. palliata* (along with which it always exists) has been found, the testimony of the Indian shell-heaps, into which it would certainly have been carried by the same means or for the same purpose as was *L. palliata*, all of these combined afford almost absolute proof that the shell did not exist on the Atlantic coast of America outside of Nova Scotia. If these same tests could be applied directly to Nova Scotia the question would be settled as to whether it occurred there. An early list of the shells of that Province, or careful investigations into its Post-pliocene deposits and Indian shell-heaps, would practically remove all doubt one way or the other. But the former does not exist and the latter has not been made.

It must have existed in Nova Scotia, if at all. But at the same time its absence from Greenland and Labrador, where, in accordance with what we know of the geographical distribution of animals, it ought to occur along with *L. palliata* if it is indigenous; the extreme improbability of its remaining in such a small area without spreading, with causes in existence tending to carry it from a less favorable to a more favorable habitat; and the impossibility of the species remaining isolated from the parent stock in England for an indefinitely long time, and yet in spite of quite a differently conditioned habitat remaining specifically identical with it, all of these facts tend to show that it did not exist even in Nova Scotia. Is not the conclusion warranted then, that *Littorina litorea* is not indigenous to America, but has been recently and artificially introduced from Europe?

ON LEMURINE REVERSION IN HUMAN DENTITION.

BY E. D. COPE.

DESCRIPTIONS of the molar teeth of man, given by anatomists, differ in important respects. Thus F. Cuvier (Dents des Mammifers) states that while the crown of the first superior true molar consists of four tubercles, those of the second and third superior true molars consist of but three tubercles. In the American edition of "Sharpey and Quain's Anatomy" it is stated that the crowns of the superior true molars of man consist of four tubercles, and the same statement is made in Allen's late work on human anatomy.

My observations having shown me that both of these descriptions apply correctly to certain types of dentition, I determined to examine for myself to ascertain, if possible, the extent and value of the variations thus indicated. My interest in the subject had been especially stimulated by the researches among the extinct Mammalia and the results which I had derived from them. These are in brief as follows: First, the quadritubercular type of molar crown illustrated by the first superior true molar of man belongs to the primitive form from which all the crested upper (lophodont) molars of the hoofed placental mammals have been derived; and second, this quadritubercular type of molar has itself been derived from a still earlier tritubercular crown by the addition of a cusp at the posterior internal part of it. This tritubercular molar in the upper series has given origin directly to the superior sectorial teeth of the Creodonta and Carnivora. In the inferior series I have shown that in known placental Mammalia, at least, the primitive molar crown is quinquetubercular or tritubercular with a posterior heel; that this form gave origin to the inferior sectorial tooth of Carnivora by modification; and to the quadritubercular type, corresponding to the superior quadritubercular crown, by a loss of the anterior inner angle and cusp. And from the quinque and quadritubercular types of lower molar crown the various specialized types of the ungulates have been derived.

Considerable significance, therefore, attaches to the question as to whether the superior true molars of *Homo sapiens* are quadritubercular or tritubercular. The inferior molars are also either quadritubercular or quinquetubercular, but less significance attaches to this modification than to that of the superior true molars.

This is owing to two facts, viz., the fifth tubercle is not the anterior inner which completes the anterior triangle of the primitive inferior molar, but is a median posterior, such as is not uncommon in Mammalia of Puerco and Eocene age; and second, because this tubercle is of quite small size and is, therefore, more liable to variation from insignificant causes.

In the nearest allies of man, the anthropoid apes, the superior true molars are quadritubercular, the posterior internal tubercle of the last or third molar being usually smaller than in the other molars in the chimpanzee. The inferior molars are quinquetubercular in the human sense, the gorilla not infrequently adding a sixth lobe on the external posterior margin of the crown. The molars of both series are quadritubercular, with an occasional posterior fifth in the inferior molars, in the Semnopithecidæ and Cebidæ, excepting the genus Pithecia of the latter, where the superior molars are tritubercular. The superior molars of the Hapalidæ are tritubercular. In the Lemuridæ the second and third, and frequently the first superior true molars, are tritubercular. In the Tarsiidæ the superior true molars are tritubercular throughout. The superior molars of the extinct lemuroids differ like those of the recent forms. Thus in Adapis and its allies they are quadritubercular, but in Necrolemur they are tritubercular. In Chriacus (whose reference to the Lemuroidea is uncertain) they are tritubercular, as is the case also with Indrodon. In Anaptomorphus they are of the true tritubercular type. This is the genus of Lemuroidea, which in its dental character most nearly approaches the anthropoid apes and man, as I have elsewhere[1] pointed out. The formula is I. $\frac{2}{2}$; C. $\frac{1}{1}$; Pm. $\frac{2}{2}$; M. $\frac{3}{3}$. The canines are small and there is no diastema in either jaw.

It may be readily seen in consideration of these facts that the appearance of tritubercular superior molars in the genus Homo constitutes a reversion to the lemurs, and not to the anthropoid apes or to the monkeys proper. And among lemurs the reversion is most probably to that type which presents the closest resemblance to Homo in other parts of the dentition. The genus which answers most nearly to this requirement among those at present known is Anaptomorphus.

In studying the dentition of man, I have examined the crania

[1] Report U. S. Geol. Survey Terrs. F. V. Hayden. Vol. III, 1885, p. 245, Pl. xxive, fig. 1, and Pl. xxv, fig. 10; and AMERICAN NATURALIST, 1885, p. 466, fig. 12.

contained in the following five collections: those of the Academy of Natural Sciences of Philadelphia; of the Army Medical Museum of Washington; of the College of Physicians of Philadelphia; of the University of Pennsylvania, and of my own museum. The first of these is especially valuable on account of the negro, Egyptian and Hindoo crania it contains. My acknowledgments are due to the Board of Curators, of which Professor Leidy is chairman, for the opportunity of studying it. The collection of the Army Medical Museum at Washington is especially important on account of the Kanakas, Esquimaux, Peruvians and North American Indians which it possesses. I am under great obligations to its distinguished director, Dr. J. S. Billings, for the facilities which he placed at my disposal. The museum of the Philadelphia College of Physicians contains the collection made by the late Professor Hyrtle, of Vienna, of crania of Eastern and Mediterranean Europeans. In this department it is unrivaled, and I am greatly indebted to the council of the college, and its curator Dr. Guy Hinsdale, for the opportunity of examining it. Some French skulls in the University of Pennsylvania were of value in the investigation. My own collection, though small, contains a number of Maoris, Australians, Tahitians and North American Indians, which have proved to be of importance. Of English and Anglo-American crania I have been able to examine but few of what might be termed the thoroughly amalgamated race. Of the latter there are probably many crania in the war collection of the Army Medical Museum, but how free the race of each may be from foreign intermixture, of course, it is impossible to know. In selecting such as are supposed to be "stock Americans," those of persons with English names have been preferred, although many now true Americans are of German ancestry. In order to increase the list of this class of examinations, I have imposed on the forbearance of my friends by frequent inspections of their dentitions in *ore aperto.*

I suspect that the characters thus obtained will prove of importance in a zoölogical and ethnological sense. They have been already found to be of great fixity, and hence significance, in the lower Mammalia. The only reason why they should be less so in man is that the modification in reverting to the tritubercular molar is a process of degeneracy, and may be hence supposed to be less regular in its action than was the opposite process of

building up, or addition of the posterior internal cusp. Some justification for a light estimate of its value may be found in the following tables. But it must be remembered that it is not always possible to determine exactly the race of the person represented by a skull even when care in its identification has been exercised. Emigration and war have constantly rendered races impure, and transplantation on a large scale has in some parts of the earth produced hybrid races. The results of a study of human crania are sure to be more or less vitiated by these circumstances. We obtain averages rather than exact definitions. Nevertheless the extremes of the series of variations are likely to be found to be characteristic of established forms of man, and will thus justify my belief in the value of the characters presented. To ascertain the relation of these variations to the races is the object of the present enquiry.

The cause of the tritubercular reversion belongs to the class of agencies active in evolution of organic types of whose real nature we know little. It can not be said to be due to a contraction of the maxillary arcade, for the Esquimaux and some other peoples which display the tritubercular dentition are not deficient in this respect. Tritubercular molars do not require less length than the quadritubercular, for the external width of the crown is the same in both cases. They require less material, however, than a quadritubercular crown, since a triangle is smaller than a square drawn on the same base line; however in some men of the lower races who present the tritubercular molars, their outline is nearly square. The hypothesis advanced[1] to account for the reduction of the number and quality of human teeth observed in the higher races, as well as for the replacement of the prognathous jaw by the orthognathous, is that such changes are due to a transference of material and of growth-energy from these parts to the superior part of the skull and its contents. The relative superiority of the dimensions of these latter parts in the higher races is supposed to account for the reduction of size of the jaws.

In the following tables the tubercular formulæ are represented by numbers. Only the last three, or the true molars, in each jaw are considered. Tubercles of reduced size are represented by fractions. Thus $\frac{4-4-4}{5-5-5}$ indicates that each superior molar is quadritubercular, and each inferior molar quinquetubercular. This represents the extreme of the series represented by the lowest races. The

[1] Proceeds. Amer. Philos. Soc., 1871, p. 252.

formula $\frac{4-3-3}{4-4-4}$ indicates that the true molars have four, three and three tubercles respectively, and that the inferior true molars have four each. This represents the extreme common among the higher races.

For clearer understanding of these characters they are arranged in the form of a table. Only the principal races are represented, and hybrids, when determinable, are omitted.[1] The characters of the superior molar teeth only are referred to. These are classified under four heads, viz., first, tubercles 4—4—4; second, tubercles 4—4—3½ or 4—3½—3½; third, tubercles 4—3½—3; fourth, tubercles 4—3—3. As already remarked, the extreme types of the series give the most precise indications of race, while the intermediate conditions have a various range.

In the first table the most obvious results are, that only the

	4—4—4	(4—4—?)	4—4—3½ / 4—3½—3½ / 4—4—3	4—3½—3	4—3—3	Totals,	
Totals	17	19	109	44	89		278
Europeans and Europeo-Americans			39	24	56		119
Esquimaux and Chuktchi			6	3	19		28
Hindus			3	1	2		6
Chinese and Japanese		3					3
N. American Indians		1	17	5	8		31
Peruvians		2	9	1	2		14
Negroes and Egyptians	7		16	5			28
Australians and Micronesians	4	13	23	2	2		44
"Malays" (? Nigritos)	6		1	3			10

three lowest races present four tubercles on all the superior molars, and that of those with tritubercular second and third

[1] Mulattoes, Mestizoes, Half-breed Indians, Gypsies, etc., are omitted.

molars, Europeans and their American descendants greatly predominate. Also that of uncivilized races the Malays and Negroes never, and Micronesians very rarely, present this type of dentition, while in the Esquimaux it considerably predominates.

I now give a table of the characters of the superior molars in the Europeans and Europeo-Americans examined. The number is not sufficient for final conclusions; nevertheless there are some indications of value. Some of the one hundred and nineteen dentitions examined are referred with doubt to their respective

	4—4—3½	4—3½—3½	4—4—3	4—3½—3	4—3—3		Totals,
Totals	11	10	18	24	56		119
Europeo-Americans	3	2	3	2	20		30
French	1			1	6		8
Germans and Scandinavians	2	3	3	8	6		22
Greeks and Italians	3	3	7	3	7		23
Western Asiatics		1		2	4		7
Slavs	2	1	5	6	11		25
Majyar				1	2		3
Lapps and Finns				1			1

races. Thus the Europeo-Americans may have been in many instances immigrants, as many such left their bones on the battle-fields of the American Civil war, where many of the crania were picked up. The supposed Germans are largely Austrians, so that some of them may be more or less Slavic or Majyar.

As results we have the following: The tritubercular dentition appears in eleven out of twenty-five Slavs; in seven out of twenty-three Greeks and Italians; in six out of twenty-two Germans and Scandinavians; in six out of eight French, and in twenty out of thirty Europeo-Americans. The only great race

which presents a similar high percentage of tritubercular molars is the Esquimaux, where they occur in nineteen out of twenty-eight dentitions. The tendency is most marked in Slavs, French and Europeo-Americans, and is least marked in Greeks and Italians, and in Germans. These two subraces stand in the series between the intermediate type of the North American Indians and the other Europeans. I have seen no English dentitions.

It is important to remember in this connection that the distinguished ethnologist and archæologist, W. Boyd Dawkins, affirms that the earliest inhabitants of Britain and some other parts of Europe were Esquimaux. He refers especially to the men of the caves, whose implements and arts he declares to be identical with those used by the Esquimaux of the present day.[1] As it is evident that the lemurine or tritubercular reversion commenced with the Esquimaux, it may be that in some instances at least its appearance in men of Anglo-Saxon and other European races is due to inheritance alone. But it is reasonable to suppose that in this case, as in other evolutions, the cause which produced this modification of the Esquimaux dentition is still active, and its frequent appearance in the most civilized races may be due to this cause as well. The progressive character of the French dentition in this respect is in broad contrast with the primitive character of that of Italians and Greeks. The characters seen in the latter go far towards sustaining Professor Huxley's hypothesis that the dark Mediterranean subraces consist of a mixture of Egyptian with the Indo-European stock.

In conclusion it may be stated that the tritubercular superior molars of man constitute a reversion to the dentition of the Lemuridæ of the Eocene period of the family of Anaptomorphidæ. And second, that this reversion is principally seen among Esquimaux and the Slavic, French and American branches of the European race.

[1] Early Man in Britain, 1880, p. 233.

EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

—— The statement is often made that teaching and original investigation are incompatible. This is not so; further, we maintain that he who is engaged in advanced studies in any department of science is far better adapted for fulfilling the functions of an instructor, at least in a college, than he who is content to allow others to make his discoveries for him. An instructor, to be thoroughly qualified to instruct, should keep himself thoroughly posted on all the recent discoveries in his province. Unless he be an original investigator he will fail to do so. He will rest content with the text-books and the little he can assimilate by reading abstracts and reviews in the semi-popular scientific journals; he will lack that enthusiasm without which no good results can be expected from the student. The original investigator has that enthusiasm. Without it he could not be compelled to go through all that drudgery which is necessary to produce good results. The student in coming into his presence is at once inspired to work, and to be thorough in his work. The original investigator is forced to keep up with the times. He must keep himself posted as to what is going on the whole world over, in order that he may not waste his time and energies in doing what has already been thoroughly performed. He goes to the bottom of his subject and his pupils may rely upon what he says; it will be the expression of the most recent opinion and will be authoritative so far as it lies in his special line. It may be said he will be narrow, and that he will have an exaggerated idea of the importance of the subject of his own chosen field. To a certain extent this is true, but not so far as one would at first think. All departments of any science are interdependent, and he who is specially engaged in one line is obliged to keep track of what is being done in the others, for he must turn in every direction for hints and comparisons. Some peculiar qualities of some substance described in the papers of some chemical journal may give the physicist just the points he needs to make some experiment a success. Some feature in the structure of a sea anemone may throw light on some problem in the development or the diseases of man. The original investigator is forced to explore every corner and keeps his mind stored with the latest discoveries, while his uninvestigating colleague sees only what chance throws in his way. Which one, other things being equal, will make the better instructor?

RECENT LITERATURE.

MILNE'S EARTHQUAKES[1].—This is a very timely work in view of the recent earthquake at Charleston. For this reason we shall for the use of our readers, abstract some of the leading points relating to earthquakes and their causes, which seem generally accepted and to accord with observed facts. While it is estimated that several earthquakes occur daily throughout the world, reference is also made to the smaller movements called "earth tremors," which occur so constantly that "it would appear that the ground on which we dwell is incessantly in a state of tremulous motion." A typical earthquake, however, consists of "a series of small tremors succeeded by a shock, or series of shocks, separated by more or less irregular vibrations of the ground." After discussing seismoscopes, instruments which are so constructed as to move at the time of an earthquake and leave a record of the motion, as well as seismographs, or record-receivers, earthquake motion is discussed theoretically, Mallet's and Abbot's results being given as well as the results obtained by the author in Japan.

A single shock is, as Mallet states, an impossibility. His statement is quoted as follows: "The almost universal succession of phenomena recorded in earthquakes is, first a trembling, then a severe shock, or several in quick succession, and then a trembling gradually but rapidly becoming insensible."

As the results of observations on the velocity of propagation of an earthquake it appears that in the Tokio earthquake of October 25, 1881, the disturbance must have traveled between Yokohama and Tokio at the rate of 4300 *feet per second*, but from Hakodate to Tokio at a velocity of 10,219 feet per second. Thus Milne concludes from his own observations and those on the Lisbon and other earthquakes, that:

1. Different earthquakes, although they may travel across the same country, have very variable velocities, varying between several hundreds and several thousands of feet per second.

2. The same earthquake travels more quickly across districts near to its origin than it does across districts which are far removed.

3. The greater the intensity of the shock the greater is the velocity.

Multiplied observations show that however chaotic at first sight appears the ruin produced by earthquakes there is in many cases "more or less law governing the positions of bodies which have fallen, the direction and positions of cracks in walls, and the various other phenomena which result from such destructive disturbances."

[1] *Earthquakes and other Earth Movements.* By JOHN MILNE, professor of mining and geology in the Imperial College of Engineering, Tokio, Japan. With thirty-eight figures. New York, D. Appleton & Co. 1886. 12mo., pp. 363.

Darwin tells us that in the earthquake at Concepcion, in 1835, the walls which ranged S. W. by W. and N. E. by E. stood better than those which ranged N. W. by N. and S. E. by S., the undulations coming from the S. W. In Caraccas, "the city of earthquakes," it is said that every house has its *laga securo*, or safe side, where the inhabitants place their fragile property. This *laga securo* is the north side, and it was chosen because about two out of every three destructive shocks traversed the city from west to east, so that the walls in these sides of a building have been stricken broadside on."

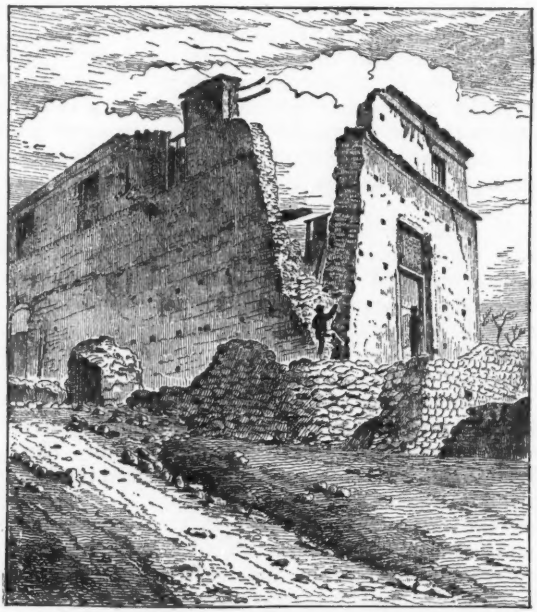

FIG. 1.—The Cathedral at Paterno, struck obliquely by the Neopolitan earthquake of 1857.

Special districts also, in an earthquake country, are free from shocks, since Milne tells us that even in a country like Japan, where there are on the average at least two earthquakes per day, it is possible to choose a place to build in as free from earthquakes as Great Britain. Caverns, wells, quarries, moats and the proximity to ravines and cañons protect a small region from the severe shocks of earthquakes.

Seismic disturbances in the ocean are discussed in the ninth chapter. Among the most striking examples is that of Iquique,

Peru. The sea-wave of the Iquique earthquake of May 9, 1877, like many of its predecessors, was felt across the basin of the whole Pacific, from New Zealand in the south to Japan and Kamschatka in the north, and but for the intervention of the Eurasian and American continents would have made itself appreciable over the whole of our globe. At places on the South American coast it has been stated that the height of the waves varied from twenty to eighty feet. At the Samoa islands the heights varied from six to twelve feet. In New Zealand the sea rose and fell from three to twenty feet. In Australia the heights to which the water oscillated were similar to those observed in New Zealand. In Japan it rose and fell from five to ten feet. In this latter country the phenomena of sea-waves which follow a destructive earthquake on the South American coast are so well known that old residents have written to the papers announcing the probability of such occurrences having taken place some twenty-five hours previously in South America. In this way news of great calamities has been anticipated, details of which only arrived some weeks subsequently. Just as the destructive earthquakes of South America have announced themselves, in Japan; in a like manner, the destructive earthquakes of Japan have announced themselves upon the tide gauges of California.

Similarly, but not so frequently, disturbances shake the other oceans of the world. For example, the great earthquake of Lisbon propagated waves to the coasts of America, taking on their journey nine and a half hours.

The complete set of phenomena which may accompany a violent sub-marine explosion is as follows (p. 174):

By the initial impulse of explosion or lifting of the ground, a "great sea-wave" is generated, which travels shorewards with a velocity dependent upon its size and the depth of the ocean; at the same instant a "sound-wave" may be produced in the air, which travels at a quicker rate than the "great sea-wave." A third wave which is produced is an "earth-wave," which will reach the shore with a velocity dependent on the intensity of the impulse and the elasticity of the rocks through which it is propagated. This latter, which travels the fastest, may carry on its back a small "forced sea-wave." On reaching the shore and passing inland, this "earth-wave" will cause a slight recession of the water as the "forced sea-wave" slips from its back.

As these "forced sea-waves" travel they will give blows to ships beneath which they may pass, being transmitted from the bottom of the ocean to the bottom of the ships like sound-waves in water. At the time of small earthquakes, produced, for example, by the explosions of small quantities of water entering volcanic fissures, or by the sudden condensation of steam from such a fissure entering the ocean, aqueous sound-waves are produced

which cause the rattling and vibrating jars so often noticed on board ships.

But out of 15,000 earthquakes observed on coast lines, only 124 were accompanied by sea-waves. Out of 1098 recorded on the west coast of South America only nineteen are said to have been accompanied by sea-waves; but from additional facts stated, almost every severe earthquake on that coast has been accompanied by considerable agitation in the neighboring sea.

"On April 2, 1851, when many towns in Chili were destroyed, the sea was not disturbed. At the time of the great earthquake of New Zealand (June 23, 1855), although all the shocks came from the sea, yet there was no flood. The small shock of February 14, however, was accompanied by a motion in the sea." To these facts, taken from Fuchs' work, our author adds the fact that the

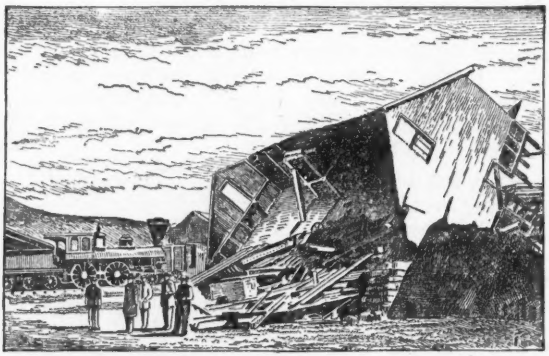

FIG. 2.—Stud mill at Haywards, California, swung completely over.

greater number of disturbances which are felt in the northeastern part of Japan, although they emanate from beneath the sea, do not produce any visible sea-waves. They are, however, sufficient to cause a vibratory motion on board ships situated near their origin.

It has been long known by physicists that the velocity with which a given wave is propagated along a trough of uniform depth, holds a relation to the depth of the trough; hence calculations of the average depths of the Pacific, dependent on the velocity with which earthquake waves have been propagated, have been made by many investigators, but Milne thinks these are open to criticisms in consequence of the writer having assumed that the wave originated on a coast line, when the evidence clearly showed that it originated some distance out at sea. As an example of such calculations we copy Milne's account of the wave of 1868:

"On August 11, 1868, a sea-wave ruined many cities on the

South American coast, and 25,000 lives were lost. This wave, like all the others, traveled the length and breadth of the Pacific.

"In Japan, at Hokodate, it was observed by Captain T. B. Blakiston, R. A., who very kindly gave me the following account:

"On August 15, at 10.30 A.M., a series of bores or tidal-waves commenced, and lasted until 3 P.M. In ten minutes there was a difference in the sea level of ten feet, the water rising above high-water and falling below low-water mark with great rapidity. The ordinary tide is only two and a half to three feet. The disturb-

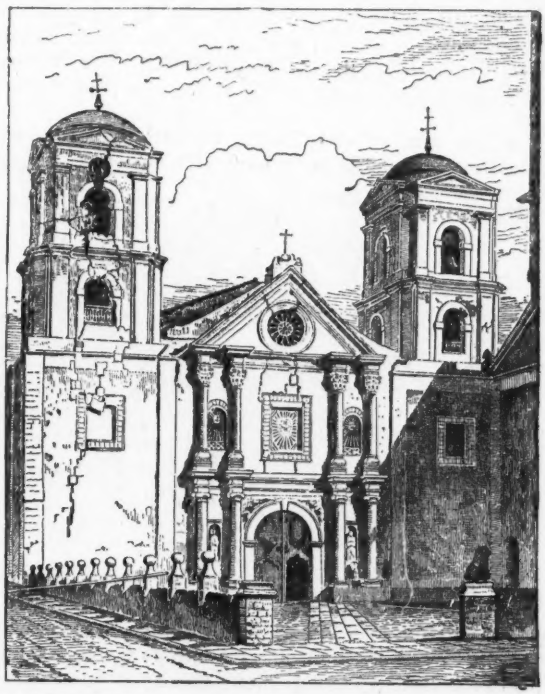

FIG. 3.—Church of St. Augustine, Manilla. Earthquakes of July 18–20. 1880.

ance producing these waves originated between Iquique and Arica, in about lat. 18°28′ S. at about 5 P.M., on August 13. In Greenwich time this would be about 13 h. 9 m. 40 s., August 13. The arrival of the wave at Hakodate in Greenwich time would be about 14 h. 7 m. 6 s., August 14; that is to say, the wave took about 24 h. 57 m. to travel about 8700 miles, which gives us an average rate of about 511 feet per second. These waves were felt all over the Pacific. At the Chatham islands they rushed in with

such violence that whole settlements were destroyed. At the Sandwich islands the sea oscillated at intervals of ten minutes for three days."

Comparing this wave with the one of 1877 we see that one reached Hakodate with a velocity of 511 feet per second, whilst the other traveled the same distance at 512 feet per second.

Other practical problems are the determination of earthquake origins and the depth of an earthquake centrum, discussed in Chapters x and xi. From Mallet's calculations the greatest possible depth of any earthquake shock is limited to about thirty geographical miles, but Milne adds that the origin of the Owen's Valley earthquake of March, 1872, was estimated (Amer. Jour. Sc., 1872) as being at least fifty miles below the surface.

Under the head of distribution of earthquakes in space and time, reference is made to a map which does not appear in our

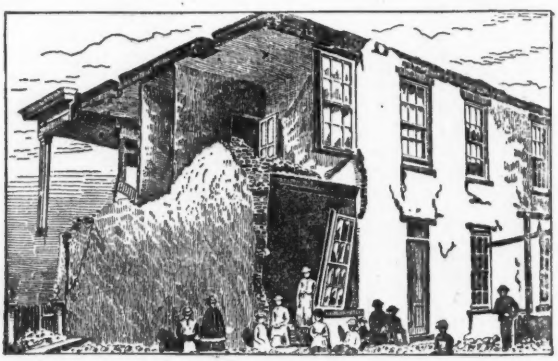

FIG. 4.—Webber House, San Francisco, Oct. 21, 1868, showing the effect produced on an end building.

copy of the book. As an example of the vast area over which an earthquake is sensible, that of Lisbon in 1755 is given, which was felt over an area of 3300 miles long and 2700 miles wide, "but in the form of tremors and pulsations it may have shaken the whole globe." Earthquakes chiefly occur in volcanic and mountainous regions. "Looking at the broad features of the globe, we see on its surface many vast depressions. Some of these saucer-like hollows form land surfaces, as in Central Asia. The majority of these, however, are occupied by the oceans. Active volcanoes chiefly occur near the rim of the hollows which have the steepest slopes. The majority of earthquakes probably have their origin on or near the bottom of these slopes."

As to the frequency of earthquakes Kluge's estimate of 4620 between the years 1850 and 1857, averaging nearly two a day, is

thought by our author to be much below the truth, as there may be perhaps ten and perhaps one hundred, it being impossible to state the number definitely.

Milne concludes, after a lengthy discussion of the facts, that the majority of earthquakes are due to explosive efforts at volcanic foci. "The greater number of these explosions take place beneath the sea, and are probably due to the admission of water through fissures to the heated rocks beneath. A small number of earthquakes originate at actual volcanoes. Some earthquakes are produced by the sudden fracture of rocky strata or the production of faults. This may be attributable to stresses brought about by elevatory pressure. Lastly we have earthquakes due to the collapse of underground excavations."

The work concludes with brief chapters on earth tremors, earth pulsations and earth oscillations.

WHEELER'S REPORT UPON THE THIRD INTERNATIONAL GEOGRAPHICAL CONGRESS.—"Better late than never" is the adage which enters the mind upon reading that the congress, the proceedings of which are here reported, was held at Venice, Italy, during the last half of the calendar year 1881. As these geographical congresses are held every five years, this volume just escapes being mistaken for a forecast of the fourth congress. Representatives from twenty-nine nationalities, embracing three-fourths of the earth's inhabitants, were present. The question of a common initial meridian and uniform standard time seems to have been the most prominent matter brought before the attention of the assembled geographers and explorers, but votes were taken upon forty-seven questions. Among these were the exact trigonometrical determination of the position of light-houses, the establishment of subordinate meteorological stations to connect polar stations with those in middle latitudes; the desirability of registering the superficial temperature of the soil; the compilation of a universal phonetic alphabet; the representation of mountains (in elementary atlases) by level curves; the fixation of a universal scheme of coloration for different heights, depths, and kinds of soil, and the preparation of lists of the explorers of each country. The Exhibition was held in seventy-four rooms in the royal palace, and was attended by about 150,000 visitors.

The principal part of the volume is occupied with an account of the Government Land and Marine Surveys of the World, commencing with a summary of the origin, organization, administration, functions, history, and progress of these surveys, with lists of the general and special topographic maps published, etc. Capt. Wheeler states that in all the older civilized countries the topographic survey is the principal one, and that in all large and well organized Governments it has been continuously maintained under military administration. No such survey now exists in the United

States. The topographic and geological surveys of the various countries are next taken up separately, commencing with Great Britain and its colonies. In Asia only one independent country, Japan, seems to have topographic and geologic surveys. Those which were inaugurated by Brazil, the United States of Colombia, Ecuador, Peru, Costa Rica, San Salvador, Guatemala, and Mexico were all stopped at the date of the writing of the report. The maps include one of the world, showing the areas which have been trigonometrically surveyed, a more detailed map of the European surveys, and another of the United States, and several sections from the topographic maps of various European countries. The advantages of the various methods of representing relief can be studied by comparing the hachures illuminated by oblique light of the Swiss atlas with those illuminated by vertical light of that of Russia, and both with the system of curves adopted in the Spanish survey. The section from Siegfried's atlas of Switzerland gives the slighter elevations in curves, the higher in hachures, and fulfills its purpose admirably. In the maps of Saxony curves and crayon shading are used, while in that of France five colors are used in combination with contour lines. There is unfortunately a lack of references to enable one unversed in all the varieties of topographic representation to understand them. The necessity of a consensus on the subject is evident.

THE MORPHOGENY OF THE VERTEBRAL COLUMN IN THE AMNIOTA.[1]—In this brochure of thirty pages Dr. Baur gives a historical review of the opinions of anatomists as to the homologies of the vertebral segments, which are most easily distinguished among the Rhachitomous Batrachia. There have been three different views on this subject, those of von Meyer, Cope and Gaudry. The opinion of Gaudry has been supported by Fritsch and Lydekker. Von Meyer regarded the intercentrum in Archegosaurus as an inferior vertebral arch, corresponding below, to the neural arch above. Cope believed it to be a distinct body, intercalated between the true centra, which he regarded as represented by the two pleurocentra. Gaudry thought that the pleurocentra and intercentrum together form a centrum, and he therefore names Cope's intercentrum "hypocentrum." Dr. Baur shows Cope's view to be the correct one on various grounds. Among these is the double bilateral origin of the true centrum in Vertebra, as shown by Müller, Roseberg, Albrecht and Froriep.

DIE CLASSEN U. ORDNUNGEN DES THIERREICHS IN WORT U. BILD; von J. G. Bronn; Reptilien, fortgesetzt von Dr. C. K. Hoffman.—This important publication is progressing in its various departments, and bids fair to reach an early completion. Many of its departments are contributed by able naturalists. The de-

[1] *Ueber die Morphogenie der Wirbelsaüle der Amnioten.* Von Dr. BAUR. Biologisches Centralblatt, August, 1885.

partment of Reptilia is represented by a considerable amount of matter contributed by Dr. Hoffmann. The anatomical portion of this work is quite thorough, and forms a valuable text-book of the subject. We cannot say as much for the systematic portion. This has been written on the principle of inserting everything without criticism. There has been no consideration of evidence as to a correct representation of nature, and the least expressive models have often been selected. No attention has been paid to questions of synonyms; hence the same genus often appears under different names, occasionally attributed to the wrong author. This portion of the work should have been confided to a more competent person.

RECENT BOOKS AND PAMPHLETS.

Smith, S. I.—Report on the decapod Crustacea of the *Albatross* dredgings off the the east coast of the U. S. A. in 1884. Washington, 1886. From the author.

Hauer, F. R. von—Annalen des K. K. Naturhistorischen Hofmuseums, Band I, Nos. 2, 3. Wien, 1886. From the editor.

Forbes, S. A.—Bulletin of the Illinois State Laboratory of Natural History. Studies on the contagious diseases of insects. 1886. From the author.

Wachsmuth, C., and Springer, F.—Revision of the Palæocrinoidea. Part III. The classification and relations of the brachiate Crinoids, etc. Phila., 1886. From the authors.

Packard, A. S.—Zoölogy for Colleges. 5th edition. H. Holt & Co., New York, 1886. $3.00.

——Briefer Zoölogy. 3d edition. H. Holt & Co., New York, 1886. $1.40.

Parker, W. N.—Elements of the comparative anatomy of Vertebrates, adapted from the German of Professor R. Wiedersheim. Macmillan & Co., 1886. From the author.

Lyman, B. S.—A geological trip to Yesso in 1874. From the author.

Boselli, E.—Il Contrasto fra l'Amore e la Bellezza. Milano, 1886. From the author.

Dawson, J. W.—Handbook of Zoölogy. Montreal, 1886. From the author.

Walker, J. M., Mrs.—Letters from a mother to a mother on children's teeth. 1885. From the author.

Herrick, C. L.—Bull. of the Denison Scientific Laboratories. The Evening Grosbeak; Metamorphosis and morphology of certain Phyllopods; Notes on American Rotifers. From the author.

Merriman, M.—Rep. of the progress of the geodetic triangulation of Pennsylvania. 1885. From the author.

Mell, P. H.—Rep. of the Alabama weather service, Aug. 1886. From the author.

Pilsbry, H. A.—Description of a new Hydrobia. Rep. Davenport A. N. S., Vol. V. From the author.

Parker, W. K.—On the structure and development of the skull in the Mammalia. Part II. Edentata. Part III. Insectivora. From Philos. Trans. R. S., 1885. From the author.

Errera, L.— Sur l'existence du glycogene dans la levure de biere. From the author.

Schlosser, M.—Palæontologische Notizen. Ueber der Creodonta. From the author.

Lesley, J. P.—The origin and distribution of the Delaware and Chester Kaolin deposits.

——Report on the Cornwall iron ore mines. 1886.

——Re-survey of the Pittsburg coal regions. All from the author.

Ashburner, C. A., Hill, F. A., and Lewis, H. C.—Notes on the Quaternary geology of the Wyoming-Lackawanna valley.

Ashburner, C. A.—Second rep. of prog. in the anthracite coal regions, Part II.

——Report on the Wyoming valley limestone beds. Both from the author.

Heilprin, A.—Fossils of the Wyoming valley limestone.

Lesquereux, L.—The vegetable origin of coal. From the author.

Jastrow, J.—On small differences of sensation. Nat. Acad. Sci., Vol. III. From the author.

Sargent, F. L.—Guide to the recognition of the principal orders of Cryptogams. Cambridge, 1886, C. W. Sever. From the publisher.

Lydekker, R.—Catalogue of the fossil Mammalia in the British Museum, Part III, 1886. From the trustees Brit. Mus.

Riley, C. V.—The mulberry silkworm. 1886. Bull. U. S. Dept. Agric.

——Report of the entomologist. 1886. U. S. Dept. Agric.

——Rep. on the cotton-worm and boll-worm. 1885. All from the author.

Smithsonian Inst.—Annual report of the board of regents, 1884.

Baur, G.—Ueber die Morphogenie der Wirbelsäule der Amnioten. From the author.

Hall, G. S., and Jastrow, J.—Studies of rhythm. From the authors.

Dall, W. H.—List of marine Mollusca. Bull. U. S. Geol. Surv., No. 24. From the author.

Barnes, P.—The present technical condition of the steel industry of the U. S. Bull. U. S. Geol. Surv., No. 25. From the author.

Howe, H. M.—Copper smelting. Bull. U. S. Geol. Surv., No. 26. From the author.

Kedzie, J. H.—Solar heat, gravitation and sun spots. S. C. Griggs & Co., Chicago, 1886. From the publishers.

Comstock, T. B.—The geology and vein-structure of S. W. Colorado. Ext. Trans. A. Min. Eng., 1886. From the author.

Crosby, W. O.—Notes on joint structure.

——Colors of soils. Ext. P. Bost. S. N. H., 1885. From the author.

Langley, S. P.—On hitherto unrecognized wave-lengths. Ext. Amer. Jour. Sci., 1886. From the author.

Smith, E. A., Aldrich, T. H., and Meyer, O.—Geological Survey of Alabama. 1886. From O. Meyer.

Hunt, T. S.—A natural system of mineralogy. Boston, Cassino. From the author.

Newton, H. A.—Meteorites, meteors and shooting stars. Science Supplement, Aug., 1886. From the author.

Morse, E. S.—Ancient and modern methods of arrow release.

Boalenger, G. A.—Description of a new Gecko of the genus Nephrurus. Ext. Ann. and Mag. N. H., 1886.

——Description of a new iguanoid lizard. Ext. P. Z. S., 1886.

——Remarks on specimens of *Rana arvalis*. Ext. P. Z. S., 1886. All from the author.

Lutken, C.—Antikritiske Bemaerkninger i Anledning af Kaempe-Dovendyr-Slaegten Coelodon. 1886. From the author.

Conn, H. W.—Life-history of Thalassema. Stud. Biol. Lab. Johns Hopk. Univ., 1886. From the author.

Lampert, K.—Die Holothurien von Süd-Georgien, 1886. From the author.

James, J. F.—On a recent synonym in the palæontology of the Cincinnati group.

——The geology of Cincinnati. Ext. Cin. Soc. N. H., 1886. Both from the author.

Call, E., and Pilsbry, H. A.—On Pyrgulopsis, a new rissoid mollusk. Ext. Proc. Dav. A. N. H., Vol. V. From the authors.

Swan, C. H., et al—Comparative size of metric and old units with reference to convenience. 1886.

Evermann, B. W.—A list of the fishes of Rockville, Franklin county, Ind.

——List of fishes collected in Harvey and Conley counties, Kansas.

——A list of the birds observed in Ventura county, Cal. All from the author.

U. S. Fish Commission—Report for 1883. Washington, 1885.

Peirce, C. N.—Function, its evolution and influence. 1886. From the author.

Evermann, B. W., and Meek, S. E.—A revision of the American species of the genus Gerres. Repr. P. A. N. S. Phila., 1886. From the authors.

Putnam, F. W., et al—Eighteenth and nineteenth annual reports of the Peabody Museum of Amer. Archæology and Ethnology, 1886. From the curator.

Rohon, J. V., and Zittel, K. A. v.—Ueber Conodonten. A. d. Sitz. d. k. bayr. Akad. d. Wiss., Munchen, 1886. From the author.

Marshall, M., Nard, M., and Beard, J., et al—Studies from the Biological Laboratories of the Owens College. Manchester, England, 1886. From Professor Marshall.

Monks, Miss—The trap-door spider. Ext. report Historical Soc. S. California, 1886. From the author.

Potts, E.—Fresh-water sponges from Newfoundland. Ext. P. A. N. S. Phila., 1886. From the author.

Leclerq, J.—La Terre des Merveilles. Paris, 1886. From the author.

Pelseneer, P.—Notice sur mollusques recueillis par M. le Capitaine Storms dans la region du Tanganyka. Ext. Bull. d. Mus. Roy. Belg., 1886.

Trouessart, M.—Sur la présence de Ricins dans le tuyau des plumes des Oiseaux. Ext. Comptes Rendus, 1886. From the author.

Eigenmann, C. H.—A review of the American Gasterosteidæ. Ext. P. A. N. S. Phila., 1886. From the author.

Wolterstorff, W.—Ueber fossile Frösche insbesondere das genus Palæobatrachus. Sep. a. d. Jahr. d. Naturwiss. Vereins, Magdeburg, 1885. From the author.

Will, L.— Oogenetische Studien. 1. Die Entstehung des Eies von Colymbetes fuscus. Sep.-abd. a. Zeits. f. Wissensch. Zool., Leipzig, 1886. From the author.

Schlosser, M.—Beiträge zur Kenntniss der Stammgeschichte der Hufthiere und Versuch einer Systematik der Paar- und Unpaarhufer. Munchen, 1886. From the author.

Albrecht, P.—Sur la place morphologique de l'homme dans la série des mammifères, 1886. From the author.

——"Herr Paul Albrecht zum letzten Male." Aus d. Sitz. d. Würzburger Phys.-med. Gesell., 1886.

——Vogelschnabel und Säugethierlippe aus d. Fortschritte der Medicin. 1886.

——Ueber die morphologische Bedeutung von Penischisis, Epi- und Hypospadiè.

——Ueber den morphologischen Werth überzahliger Finger und Zehen. Sep.-abd. a. d. Centralblatt fur Chirurgie, 1886.

——Ueber den morphologischen Sitz der Hasenscharten Kieferspalte. A. d. Biologischen Centralblatt, 1886.

——Ueber die Vorderflosse von Protopterus annectens. Sitz. d. k. preus Ak. d. Wissensch. All from the author.

Wiley, H. W.—The economical aspect of agricultural chemistry. Address delivered before the A. A. A. S., Buffalo, 1886.

GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

GENERAL.—In a recent number of the Mittheilungen of the Geographical Society of Vienna, Dr. Penck takes issue with the usually accepted proportions of land and water (1 to 2.76), asserting that the unknown regions around the poles are too extensive to permit of any reasonable approach to accuracy in this respect.

M. Rambaud gives the extent and population of the French colonies, or rather possessions. Including Tonkin and Madagascar, these comprise about 1,800,000 square kilometers, and about twenty-four and a half millions of people. In this total the population of the French Congo possessions is not included, and Tonkin is credited with only 12,000,000 of inhabitants. The commerce with these colonies was, in 1883, about 915,000,000 of francs.

Major Feilden, naturalist of the Arctic expedition of 1875–76, has given in his adhesion to the belief that through the secular cooling of our planet the poles became first fitted for the reception of life; that in Palæozoic times the north pole possessed a climate at least as warm as that now experienced at the equator, and that during the Miocene period the temperature, though gradually cooling, supported a flora which spread southwards.

AMERICA.—*The Xingu.*—Petermann's Mittheilungen (Nos. 5 and 6) contains a full account, with maps, of the German Xingu expedition of 1884. The Xingu is formed by the union of three large rivers: the Kuliseii, the Ronuro and the Batovy, the last of which falls into the Ronuro a little above its confluence with the Kaliseii, which may be considered the main stream. The expedition descended the Batovy, which flows in numerous bends through a flat country, but is intersected by many rocky strata forming rapids. After the confluence the Xingu flows through a level country till it reaches 10° S. lat. Here it enters granite hills and forms the Martius cataract. From 10° to 3° the Xingu receives only two important affluents, both from the left. At 3° 40′ begins the great bend of the Xingu, the cataracts upon which were explored by Prince Adalbert of Prussia in 1842–'43. Within this bend the river falls 260 feet. At its confluence with the Amazons the Xingu is a mighty stream nearly five miles wide. The different branches of the Xingu are inhabited by no less than eighteen different Indian tribes, though the total population does not exceed 2,000. The Suya Indians live in beehive-shaped houses with a diameter of thirty-three feet.

American News.—Lake Tahoe is dethroned from its position as the deepest lake upon the continent, Captain Dutton having found a depth of 1996 feet in Crater lake, Oregon. The average depth is about 1490 feet. The shores of this lake are very

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

precipitous, and the same rapid descent continues below the water, so that depths of fifteen to eighteen hundred feet are found all around the margin. It had been previously sounded by Capt. G. M. Wheeler, U. S. Engineers.——M. Charnay has, during his last season of exploration in Yucatan, discovered the remains of a town called Ek Balam, or the city of the black tiger. Also, upon an island about eight leagues north of Campeachy, he found a Maya burial ground which had never before been visited by a man of science.

AFRICA.—*Mozambique.*—The Portuguese are aiding to fill up some of the gaps upon the map of Africa. An expedition to the gold mines of Marica, worked at a time of which no records have reached us, has resulted not only in the formation of a new town, Villa Gouveia, but in theexploration of the lower course of the Aruangua or Pungue, which proves to be navigable for a considerable distance, as are also the Revue and Buzi, the conjoined streams of which enter the ocean slightly to the south of the Pungue. There appears to be a channel connecting the Pungue with the Inhandué, the tributary of the Zambezi upon which the new town is situated. Lake Sungue, which varies much in size according to the season, discharges by the Urema into the Pungue, while the Mucua connects it with the Zangue or lower course of the Inhandué.

A tolerably full description of the Comoro islands is contained in the Revue Scientifique (August 7). The religion is Mohammedan, and the people a mixture of Arabs and Caffres, with Madagascans, etc. The largest island, Great Comoro or Angazia, has a superficies of 1100 kilometers. Moheli is the smallest but most fertile of the group; Anjouan has the best harbor and is most frequented by Europeans, and Mayotte, or Mahore, the most southern and western of the archipelago, belongs to France.

Petermann's Mittheilungen (July) contains an account of the German expedition of 1884–'85 to Angra Pequeña, or Luderitzland. The immediate neighborhood of the settlement is described as a dreary spot where there is scarcely any living thing but snakes and lizards. A short distance to the north are extensive dunes reaching a height of 500 meters. The interior does not appear to be much better. River beds are dry even in winter. Snakes, scorpions and beetles seem to have been the most noticeable objects. Aus and Gubub, east of 16° E. long. and about 26° 40′ S. lat., are the highest points of this part of Africa, the level falling to the south towards Orange river. The scenery here consists entirely of barren table-mountain, between which and the ocean extends a broad sandy plateau. Further to the south a grassy region was found. Dr. Pohle reports an entirely negative result; the want of rain-fall and lack of drinking water unfit the district for colonization; minerals are few, and vegetation is so scarce that man and beast could scarcely be kept alive.

It has been proven that workable deposits of petroleum exist

on the Egyptian shore of the Red sea. The material, which has lost its more volatile components, is found at the level of the sea upon piercing the recent coral formation of the foreshore. Col. Ardagh believes that the source of the petroleum is in the older limestone beneath the coral.

M. Aubry, during his visit to Shoa in 1883–'84, surveyed the source of the Hawash and its course for about 190 miles, and also surveyed the Mugueur, a tributary of the Blue Nile.

EUROPE.—*Surveys in the Pyrenees.*—Recent surveys in the Pyrenees, by M. Schrader, aided by the explorations of Dr. Jaubernat, have proved the existence of a lake, the largest on the northern slope of the Pyrenees, in a gap between two chains of peaks, which, approached from opposite sides, had previously been supposed to be identical. M. Schrader states that on the south and south-east of the Aran valley are several ranges, nearly 10,000 feet high, that are unnoted on any geographical map. The Aran valley is tributary to the Garonne.

ASIA.—*Burmah.*—The August issue of the Proceedings of the Burmah Geographical Society contains an interesting account of Burmah, the country and people, by Mr. J. A. Bryce. The topography of the region, the physical and other characteristics of the races which inhabit it, the productions and climate, and the present status of the various nationalties, are discussed. Mr. Bryce fears that the Burman, in spite of that vigor which has enabled him to continue dominant for two thousand years, will succumb to the more energetic Shans and Kakhyens (Singphos), now that his empire has been put an end to by the British. The Burmese occupy the upper part of the Irawadi delta, the upper valley of the Sittang, a narrow space on each side of the Irawadi in Upper Burmah, and the Moo valley, between the Irawadi and the Kyendwin. The Talaings still form the bulk of the population in the delta of the Irawadi and Sittang. The Talaings are smaller, plumper, fairer and less hard-featured than the Burmese, while the Shans are bigger and stouter than the dominant race. Mr. Bryce puts the total population at seven and a half millions, about half of them Burmese.

The Drying up of Siberian Lakes.—The rapid drying up of the lakes of the Aral-Caspian region is not limited to the two great lakes which give their names to it. M. Yadrintseff, in the Izvestia of the St. Petersburg Geographical Society, gives two maps, one representing a group of Siberian lakes, according to a survey made in 1784, the other giving the same lakes as they appeared in 1813, 1820, 1850, 1860, and finally in 1880. The group consisted of three large lakes, Tchany (the largest), Sumy, and Abyshkan, and the small lake Moloki, between Abyshkan and Tchany. The latter lake has greatly dwindled since 1784. Lake Moloki has diminished from twenty

miles in length to three; and Lake Abyshkan, in the early part of the century forty miles from north to south and seventeen from east to west, is reduced to three small ponds, the largest scarcely a mile and a half wide. Another lake, Tchebakly, which in 1784 was forty miles by thirty, is also now reduced to three ponds, the largest less than two miles across.

Among the results of the New Zealand earthquake are the addition of 300 feet to the height of Mount Tarawera, and the subsidence of the beautiful Lake Rotomahana, which is transformed into an expanse of seething mud. Its renowned terraces are reported to be destroyed. Large areas are covered with volcanic dust and mud. Lake Rotomahana was the wonderland of the volcanic belt of the North island, as it was surrounded with terraces of silica from which issued hot springs and geysers.

The Transcaspian railway was, on the 14th day of July, opened for traffic as far as Merv. The entire length of the line to Samarcand will be 1335 versts, or 890 miles. Three hundred versts of this is in Bokharan territory. Between Michailovsk, on the Caspian, and Samarcand, there are in all sixty-three stations, several of which have to be supplied with water by pipe-lines or water-trains, while others are provided with artesian wells.

Mr. H. O. Forbes has returned to New South Wales. He was unable to ascend the Owen Stanley range, but reached a point sixty-five miles from Port Moresby.

GEOLOGY AND PALÆONTOLOGY.

A Remarkable Extinct Geyser Basin in S. W. Colorado.[1]—In many features the Yellowstone National Park region is closely paralleled by several other districts. In its geography, and to a large degree in its geognosy, it does not materially differ from a portion of the country adjacent to the elevated "pinnacle," which parts the waters of the Rio Grande, the Arkansas and the Colorado. As early as 1879, my own familiarity with the former area led me to the detection of traces in Southern Colorado of the same action which has marked the later stages of volcanic decadence in the park. Afterwards, from month to month, evidences of this nature multiplied from further researches, until in 1882 it was safe to announce that a considerable portion of the San Juan mining region is covered by the deposits from ancient thermal springs.[2] At this time the peculiar *bonanzas* of the Red Mountain district began to receive attention, and the predictions of the writer, based upon the foregoing conclusions, were invariably verified in the exploitation of the mines. But the development of the ore-bodies and much more detailed examination of

[1] Read before Section E., A. A. A. S., Buffalo Meeting, 1886.

[2] Notes on the geology and mineralogy of San Juan county, Colorado, by Theo. B. Comstock. Published in Trans. American Institute of Mining Engineers, Vol. XI, pp. 165–191 (*with map*).

the area in question, revealed other and more interesting facts concerning the growth of the lodes in this restricted area. It soon became evident that the extremely peculiar topography of the country at the head of Red creek, in Ouray county, could have been produced only by the accumulative action of numerous enormous geysers, far more effective than those to-day at work in the Yellowstone Park, though occupying, perhaps, a less extensive basin. Probably, however, not a little of the area over which the hot spring deposits can be traced, may have been the seat of important geysers. In fact, there are reasons for making this statement more definite, but it will be best to confine ourselves to what can be clearly described in a few words, without consideration of nice structural details.

The upper valley of Red creek is thickly studded with mounds of varying size, but not widely different in form. All these are more or less closely connected with the present (or comparatively recent) local drainage, which is also bounded at irregular intervals by dry pits and pools of cold water quite similar to the bowls of existing hot springs in other localities. The remarkable characteristics of this basin are the number and the magnitude of the mounds and the total absence of active thermal springs, notwithstanding the existence of such in localities not far distant, as at Ouray. The altitude of the district is from about 9500 feet to 12,000 feet, whereas few, if any, of the present hot water bowls are known above 6500 feet, hereabouts.

The cañon of Red creek is undoubtedly not one wholly of aqueous erosion, but the drainage has been induced in part by seismic action, modified in an interesting manner by glacial scorings and subsequent diluvial deposition. The Red Mountain geyser area, as we may designate this tract, is now topographically restricted, as here indicated, almost wholly to the upper portion of this interesting cañon, but it may be really separated into three well-marked basins, which formerly fed as many separate affluents of the main stream. Two of these are proven to be metalliferous, while the third is almost unexplored, though giving indications of similar character, but less promising perhaps.

The geyser areas do not seem to extend beyond the region of maximum intensity of the volcanic action in the rhyolytic period, and the ore-bodies all furnish evidence of secondary reactions taking place in the line of a prominent fault-fissure of that age. All along this course over a considerable breadth of territory, the remains of extinct thermal springs are (recognizably) most abundant, but the geyser character is not noticeable far towards the north or south of Red peak.

The transformations in the vein material, the aggregation of the ores into bonanzas (as at the Yankee Girl, Alaska and Old Lout mines, among others) with the very remarkable distribution of minerals in the lodes, are but a few of the intensely interesting

details which can be there studied to the best advantage. Much that is there revealed has already thrown new light upon the origin and life-history of metalliferous deposits, but I cannot now touch upon these topics.[1] The gigantic geyser-mounds are in themselves of marked interest, not only from their great size and external configurations, but also on account of their internal structure as proven by the excavations made in some of them for mining purposes. The American Belle, Grand Prize and other mines were opened directly in mounds of this nature, and (as in many other cases where only ordinary thermal springs probably existed) caverns were invariably entered after passing through an outer shell of considerable thickness. In nearly all of these some connection with the surface was traceable by following the tracks of woodchucks, which had utilized the passages as domiciles. In the caverns, which are sometimes of large dimensions, there is usually a deposit of sulphuretted ores, with allied minerals, with a very considerable amount of yellow and red material resulting from its oxidation and the production of carbonates.

No doubt much valuable information bearing directly upon the life-history of the geyser may yet be gathered from detailed studies in this district. But little real exploration underground has yet been accomplished, and that small amount is but partially known to those who can make the best use of it for scientific purposes. All that the writer has yet observed agrees in most essentials with what may be seen in the extinct subterranean passages at Gardiner's river, Wyoming, except that the metalliferous deposits and the geyseritic relics are peculiar to the Red Mountain area.—*Dr. Theo. B. Comstock, Champaign, Illinois.*

Schlosser on Creodonta and Phenacodus.[2]—Dr. Schlosser has attacked the problem of the Creodonta with his accustomed skill, and has thrown the additional light of his extensive acquaintance with mammalian anatomy on the subject. His opinion of the affinities of the group are as follows: He regards the Creodonta, with Cope, as a sub-order, but not like him, of an order Bunotheria, but rather with Lydekker, of the order Carnivora. He does not regard them as ancestral to the Carnivora, but as having had a common ancestor with that order. This common ancestor he derives from hypothetical Marsupialia with numerous temporary teeth. He excludes from the Creodonta the Hyænodontidæ and Miacidæ,

[1] The writer has announced these discoveries and given some of his own conclusions in a series of articles puplished in the Engineering and Mining Journal, 1882–84 inclusive, ("Distribution of San Juan county Ores"); in a further series in the same journal, 1884–86, now running ("Metallurgy of San Juan county Ores"); also in the paper previously quoted in Trans. Am. Inst. M. E., and at greater length in the same Transactions, May, 1886 ("Geology and Vein-Structure of S. W. Col," with four maps).

[2] Ueber das Verhaltniss der Cope'schen Creodonta zu den übrigen Fleischfressern; Morphologisches Jahrbuch 1886, p. 287, von Dr. Max. Schlosser.

regarding both as true Carnivora; the former on account of the supposed scapholunar bone reported by Gervais, the latter on account of the single flesh-tooth. He restricts the Creodonta to those forms which have two flesh-teeth, if any. From the Leptictidæ he excludes the genera Leptictis, Mesodectes, and Ictops, placing them in the Insectivora. He therefore changes the name Leptictidæ to Proviverridæ. Schlosser does not agree to the introduction to the Creodonta by Cope of the tritubercular families usually referred to the Insectivora, viz., the Talpidæ, Chrysochloridida, Centetidæ, Mythomyidæ. and Tupæidæ; but he does not give his reasons for this view.

The following remarks may be made on the above positions of Dr. Schlosser. The supposition that Hyænodon possesses a scapholunar bone has been shown by Professor Scott to be an error, so that this form must be retained in the Creodonta, to which it is connected by Pterodon. Specimens of Miacidæ in the Princeton Museum show that this family also possessed no scapholunar bone. This, together with the non-trochlear astragalus which I have described, shows that the Miacidæ must also be referred to the Creodonta. These points admitted, it becomes much easier to believe that the Carnivora are the descendents of Creodonta, through the Miacidæ. (The supposed connection between Oxyænidæ and Felidæ I denied in my last phylogeny in the article on Creodonta in the AMERICAN NATURALIST for 1884.) The exclusion of the three genera above named from the Leptictidæ, (Proviverridæ) has little significance, until the reasons for separating the Creodonta from the tritubercular Insectivora can be shown.

Dr. Schlosser's representation of my phylogenetic views is very inaccurate, owing to a misunderstanding of the dates of publication of my respective papers. The oldest of these is the Vol. III. Report U. S. Geol. Survey Terrs., sent to press in 1879, and not issued until February, 1885. The next in point of date are the illustrated papers on extinct Vertebrata, issued at various times in the AMERICAN NATURALIST. My latest phylogenetic opinions, delivered from fuller material and more mature reflection, were published in a paper on the "Evolution of the Vertebrata, Progressive and Retrogressive," in the February, March and April numbers of the AMERICAN NATURALIST for 1885. In the last of these papers the Lemuroidea are separated from the Bunotheria and placed in the Taxeopoda near the Condylarthra, to which they are allied. This does not include the Mesodonta (Pelycodus), which being unguiculate, remains with the Bunotheria. In the above paper all are derived from carnivorous Marsupialia, in accordance with the view of Hæckel's "Schöpfungsgeschichte."

Dr. Schlosser generously acknowledges, in another page, the prior indication of the ancestry of the Phenacodus and Hyracotherium of the horse line to his own, by Dr. J. L. Wortman in the

Revue Scientifique, Vol. XXXI, p. 705. But these relations had been previously pointed out by myself; that of Hyracotherium in the Palæontology of the Report of the Survey W. of the 100th meridian in 1877; and that of the Phenacodus in the Proceeds. Amer. Philos. Soc., 1881, p. 178.[1]—*E. D. Cope.*

DOLLO ON EXTINCT TORTOISES.[2]—The distinguished Belgian anatomist, M. Louis Dollo, has recently published two important papers on extinct tortoises from the Eocene formations of Belgium. The theme which gave rise to the first of these, is the description of a new genus and species of Chelydridæ, *Pseudotrionyx delheidi* Dollo. In preparing to do this, the author reviews the classification of the Testudinata in an extremely able manner. He adopts the system of Cope in the main, and in giving his reasons for doing so makes an important contribution to the subject. He differs in some details from the author of that system. Thus he separates Eurysternum from the Chelydridæ as type of a distinct family, because it possesses a fontanelle of the plastron; a character which the reviewer does not regard as of family value. He also unites the Propleuridæ with the Cheloniidæ, but as we shall see, he reëstablishes it as a sub-family in the second paper quoted, without apparently being aware of the fact.

M. Dollo somehow supposes that the author of the system he adopts regards the plastron of the Testudinata as homologous with the sternum of other Vertebrata, and also that the names he employs for the elements of the plastron are original with him. This is an error. The terms "postabdominal," etc., were introduced by the distinguished English anatomist, W. K. Parker, and the author criticised by M. Dollo, has stated in one of his papers, on which I cannot at this moment place my hand, that he adopts the views as to the homologies of the plastron, held by that authority. But M. Dollo thinks that the names Dactylosterna, Clidosterna and Lysosterna imply the erroneous homology with the sternum, and should therefore be charged. He then names these divisions Dactyloplastra, etc. Now names ought not to be changed without better reasons than those offered by M. Dollo, for the well-known *opprobrium scientiæ* is the multitude of names. Those in question were not given under an erroneous idea, but the word "sterna" was used figuratively, just as it is in many genera of the order. As well might M. Dollo change the generic names Eurysternum, Pleurosternum, etc., into Euryplastron, Pleuroplastron, etc. And this our author has not yet done.

The plates called intergular by me in Baëna appear to me to be homologous with the corresponding plates in Pleurodira, although

[1] Also in NATURALIST for 1881, p. 1017.

[2] Première note sur les Cheloniens du Bruxellien de la Belgique; (Bull. Mus. Roy. Belgique 1886, p. 75). Premiér Note s. l. Cheloniens Landeniens de la Belgique; (l. c. 1886, p. 129).

M. Dollo thinks not and finds occasion for the creation of a new name. Adocus, another Cryptodire genus, has a single one well developed.

In his second article M. Dollo separates certain species referred by Professor Owen to the genus Chelonia, as representatives of another genus which he names Pachyrhynchus. It is characterized by the underroofing of the posterior nares, and by the great extent of the mandibular symphysis. He regards this character as requiring the creation of a sub-family of the Cheloniidæ, the Pachyrhynchinæ. The present writer has, however, described the same characters in two genera referred by him to the Propleuridæ (Euclastes and Lytoloma) and has referred to one of the European species (*Chelone planimentum* Owen—Pachyrhynchinæ Dollo) as presenting this character.[1] M. Dollo's genus is probably one of the American forms, and his Pachyrhynchinæ is the Propleuridæ Cope. M. Dollo's family characters are, however, better than those given by Cope.—*E. D. Cope.*

Geological News.—*General.*—M. Steinman recently gave to the Swiss Society of Natural Sciences an account of his explorations in the Southern Cordillera. The fossil fauna and flora are almost identical with those of European formations. The Upper Trias, Rhætian, Lias, Jurassic and Cretaceous are well reprerented.——Montpellier-le-Vieux, a city of eroded rocks, situated twelve kilometers from Millau, in the department of Aveyron, France, seems, according to a note of M. E. A. Martel, to be in some respects even more wonderful than the Garden of the Gods or Monument Park. A mass of rocks, sixty to eighty meters high, simulates an embattled donjon, and is called the citadel. Around this, five depressions, 100 to 124 meters deep, seem in one spot to form an amphitheater, in another a necropolis, in another part an open plaza, and again a city with narrow streets, obelisks, gates, etc., recalling Pompeii, Karnac or Persepolis. The whole is surrounded by a rocky wall exteriorly, 100 to 150 meters high; ravines passing through the talus of this simulate ditches, and outside of all this many groups of ruined rocks constitute a ceinture of detached forts.——J. Stirling has recently contributed to the Linnean Society of New South Wales a paper on further evidences of glaciation in the Australian Alps. The author and Dr. Lendenfeld found erratics, perched blocks, smoothed surfaces and old moraines upon Mount Bogong, the highest mountain in Victoria.

Silurian.—M. Hebert, who has for a considerable period been occupied with the study of the most ancient sedimentary rocks of the northwest of France, has come to the conclusion, that in Northern Brittany and Western Normandy the vertical slates (phyllades) of Saint Lo are at the base, while upon them lie the

[1] Transactions American Philosophical Society, 1870, pp. 146–8.

almost horizontal purple conglomerates, schists and red sandstones.——W. S. Ford (Amer. Jour. Sci. June, 1886) describes *Obolella desiderata* Billings, under the name of Billingsia, on account of peculiarities of the ventral valve which he considers generic.——A. M. Seely (Amer. Jour. Sci., July) describes three new species of sponges of the genus Strophochetus, and notes the distribution of the genus through the Middle Chazy.——Professor N. S. Shaler contributes to the same issue an account of the geology of Cobscook Bay district, Maine. The uppermost beds of the series contain fossils which he refers to the Devonian, possibly to the Ohio shale. Below these are beds which seem to belong to the Niagara and Clinton horizons, while the most numerous list of fossils seems to be of Lower Helderberg horizon. The series is less rich in organic forms than that of the St. Lawrence or of Central New York. The land area of this fiord region is principally occupied by intrusive volcanic rocks.

Tertiary.—M. Cotteau, in his last memoir upon fossil Echini, enumerates fifteen species of Brissopsis.——Mr. Clement Reid has recently studied the Pliocene deposits at Diest and Antwerp, after which he examined the deposit of ironstone at Lenham, England, the fossils in which were, in 1857, referred to the Pliocene by Professor Prestwich. The examination resulted in a thorough confirmation of Professor Prestwich's identification, which had been disputed. There is not a single Eocene species; with two or three exceptions all are known Pliocene forms, but many are represented by species now living in the Mediterranean. ——Dr. Otto Meyer contributes to the Amer. Jour. Sci., July, 1886, some observations on the Tertiary and Grand Gulf strata of Mississippi. His conclusions are (1) that in no place can Grand Gulf strata be seen in superposition over the marine Tertiary; (2) that there are two places where strata undistinguishable from Grand Gulf can be seen overlaid by marine Tertiary; (3) that the Grand Gulf formation is mainly not marine; (4) that a thick and extended marine green-sand formation with a Claibornian fauna, approaching the Jacksonian, is found in Eastern Mississippi.

Post-tertiary.—M. A. Gaudry recently exhibited to the Paris Academy of Sciences a reindeer's antler pierced with a large hole, and covered with well-executed carvings. One face shows two seals, a fish (salmon or trout) and three twigs of plants. One of the seals seems to be *P. vitulina.* On the other face are two eel-like slender animal figures, three indeterminable animals (alike) and an insect. This fragment of the reindeer age was discovered by M. Poignon in the Montgaudier caves, department of Chavente.——A valuable paper upon the post-Tertiary elevation of the Sierra Nevada, as shown by the river beds, has been contributed by Professor Jos. LeConte to the American Journal of Science. The cañons of California, cut far below the ancient

river-beds, are correlated with the features of the plateau region to prove a great elevation which was permanent, while the drift and river deposits of the eastern region prove subsidence after Tertiary times.

BOTANY.[1]

How shall Botany be taught in Agricultural Colleges?—Numerous factors enter into the problem, such as the size of the class, the age and preparation of the students, the season of the year, the length of the college term, the probability of subsequent study, the means of illustrations which can be commanded and many other similar considerations. All of those factors are so different and so variously combined, that a method, which on the whole might be the best in some particular case, might not be the best in any other case whatever.

Roughly classified, we may make out three different methods of teaching botany now in vogue; these may be termed the text-book method, the lecture method and the laboratory method.

It is fashionable now-a-days to decry the text-book method as altogether out of date, but in the hands of a competent teacher a good text-book is a most valuable aid. The lecture method is necessary in very large classes, but satisfactory results are rarely reached, even with the aid of copious means of illustration and a fairly good work of reference in the hands of the student. Nor is the laboratory method, pure and simple, altogether free from objection. Left largely to himself to find out important facts in regard to the specimens he is given to study, the student is sure to go astray and waste much time, a loss needless and inexcusable.

A judicious combination of the methods named would in all probability secure the best results in a majority of cases.

Let me suppose the class to number from thirty to forty, composed of young men of average attainments and ability, and that from three to five hours per week for a year is to be given to the subject. A desirable time for beginning the work of instruction is at the opening of the winter term, which in most colleges is soon after New Year's. For the first term the object is to gain a general view of plants and plant-life. The basis of the instruction should be lectures or talks, occupying a part of the hour, which the teacher can vary according to the needs of the class. An excellent accompanying text-book is Bessey's Essentials of Botany, from which pages may be occasionally assigned as a lesson to be carefully learned. Every subject taken up should be copiously illustrated with specimens which the student is to see and examine for himself. Occasional days are to be set aside for careful reviews of subjects already studied, and from time to time opportunity should be afforded for the examination of specimens under the microscope.

[1] Edited by Professor Charles E. Bessey, Lincoln, Nebraska.

The special advantage of this method of instruction here suggested is two-fold: First, its flexibility; and second, the opportunity it affords for the effective use of the black-board. Figures and diagrams, drawn before the class, in which various phases of development can be shown, are far more valuable than any text-book figure, or previously prepared diagram. Nor should the advantage of giving out suitable topics or problems for the members of the class to examine and report upon, be overlooked. The skillful teacher will find no difficulty in assigning appropriate subjects, which will require independent observation and thought on the part of the student.

A term's work of this kind should give such a comprehensive view of plants as to make subsequent studies to the highest degree valuable and effective.

A second term may be devoted mainly to the higher plants. By this time the spring has so far advanced that an abundance of material for all sorts of works may be obtained. The basis of instruction may still be in the form of familiar lectures, but Gray's Lessons may be used and carefully studied. The instruction should be so planned that the work in class-room and out shall require a large amount of observation and study of plants themselves. Some time may be devoted to the identification of species, not that the name of the plant is the object sought, but that the work in question cannot help but increase the knowledge of the student in regard to the structure of plants, their differences and resemblances. A special study of particular subjects may be made, such as pollination, and the variations in structure and development relating thereto. Certain natural orders may be more carefully studied, and written descriptions and figures of some species or genera, made from the student's own observation, may be required. Some work also in the preparation of herbarium specimens, if thoroughly well done, is always profitable.

A third term may be given to questions relating to the physiology of plants. I do not know of any subject more important to an agricultural student than this. The instruction here must be largely in the form of lectures. Goodale's Physiological Botany is a most admirable work. It is perhaps too comprehensive to be used as a text-book in ordinary classes, but would be serviceable as a work of reference. Some well arranged laboratory work in the histology of plants is very desirable as a part of the instruction in the subject now under consideration. A special effort should be made on the part of the teacher to illustrate his instruction with as many experiments as possible. Many of these must be commenced long before they are needed for use in the class-room. One actual experiment which the class can see, is worth a large number of mere descriptions of experiments. Nor is it difficult to devise, in a fairly equipped laboratory, especially if a greenhouse is also available, a large number of experiments, which the student

can himself conduct, make his own observation and prepare a report of the results.

To my mind the scheme which I have here outlined rather than described, suggests at least a desirable method of teaching botany under the limitations named. It is capable of a great deal of modification as circumstances demand, and in the hands of a skillful teacher is likely to produce satisfactory results. In case the instructions end with the year, the student has acquired as large and useful a knowledge of plants as could reasonably be expected; and if he is to continue his studies further, he has an excellent foundation for thorough work in special subjects.

I think we are all agreed there is no royal road to learning; and I am sure that to no subject is this truth more applicable than to botany. And in conclusion I would suggest that the value of any method of instruction may be tested, first, by the extent and accuracy of observation which it calls forth on the part of the student, and second, and chiefly, by the amount of earnest and thorough work which it leads him to do.—*Professor A. N. Prentiss, in American Horticulturist.*

Botanical News.—A most important paper is now in course of publication in the Journal of the Linnean Society, beginning with the first number of Vol. xxiii. It is an "Enumeration of all the plants known from China proper, Formosa, Hainan, the Corea, the Luchu archipelago, and the island of Hong Kong, together with their distribution and synonymy," and will bear the title of "Index Floræ Sinensis." It is the joint work of Francis B. Forbes and William B. Hemsley. Already one hundred and sixty pages have appeared, covering the enumeration from Ranunculaceæ to Leguminosæ. A fine map of the region accompanies the work.——Thomas Morong's paper on the "Naiadaceæ in the Torrey Herbarium," published in the September number of the Torrey Bulletin, is a most useful one. It enumerates seventy-three species, of which *Potamogeton wrightii*, *Zannichellia indica* and *Zostera marina* L., var. (*?*) *latifolia* are described for the first time.——In the same journal Dr. Vasey publishes a synopsis of the genus Paspalum which will prove valuable to graminologists. Twenty-six species are described.——A late number of the Gardener's Chronicle (Sept. 4) contains an excellent wood-cut of the nut-pine of Colorado (*Pinus edulis*) from a drawing by Sir J. D. Hooker. It is accompanied by a short descriptive note.——The September Botanical Gazette is an "Association number," containing articles on the botany of the recent meeting of the American Association for the Advancement of Science, the Botanical Club of the association, with an installment of the papers, and numerous notes and notelets.

ENTOMOLOGY.

KRAEPELIN ON THE ORGANS OF SMELL IN ARTHROPODS.[1]—To Leydig it was first given to make a decided step in advance. In different writings[2] had this naturalist busied himself with the integumental structures of Arthropods, and declared Erichson's view as to the olfactory nature of the antennal pits as the truest, before he, in his careful work on the olfactory and auditory organs of crabs and insects (14), gave excellent representations of the numerous anatomical details which he had selected from his extensive researches in all groups of Arthropods. Besides the pits which were found to exist in Crustacea, Scolopendræ, beetles, Hymenoptera, Diptera, Orthoptera, Neuroptera and Hemiptera, and which had only thus far been regarded as sense-organs, Leydig first calls attention to the widely-distributed pegs and teeth, also considering them as sense-organs. "Olfactory teeth," occurring as pale pegs, perforated at the end, on the surface of the antennæ of Crustacea,[3] Myriopoda, Hymenoptera, Lepidoptera, Coleoptera, are easily distinguished, and besides the "olfactory pegs" of the palpi, may be claimed as organs of smell. The nerve-end apparatus first discovered by Hicks in the halteres and wings, Leydig thinks should be ranked as organs of hearing.

Regarding the Crustacea, Leydig, in his latest work,[4] gave a lasting explanation of the nature of the pale peg or cylinder on the end of the antennæ which he found in new groups of this class, which was adopted by a large number of naturalists. Thus Claus,[5] in his different essays, expressed the view that these Leydigian organs had the function "of making sensible slight changes in the chemico-physical condition of the water." Indeed, in his later essays[6] he without hesitation calls the structures in question "olfactory teeth," while he at the same time offers a series of anatomical data on the finer structure of the same. Entirely

[1] Translated by A. S. Packard. Concluded from p. 894.

[2] *Leydig:* Zum feineren Bau der Arthropoden, Müller's Archiv, 1855, 376–480; Zur Anatomie der Insekten, Archiv für Anatomie, 1859, pp. 35–89 and 149–183; Lehrbuch der Histologie, 1857, 220.

[3] These pegs, as occurring in Asellus and Daphnidæ, had already been well described, in 1860, in his monograph "Naturgeschichte der Daphiden," Tübingen, 1860, without, however, a discussion of the question whether they were olfactory organs.

[4] *Leydig:* Ueber Amphipoden und Isopoden, Zeits. f. w. Zoologie, XXX, 1878, 225–274.

[5] *Claus:* Ueber die Organization und Verwandtschaft der Copepoden, Würzburg, 1862, 19; Die freilebenden Copepoden, Leipzig, 1863, 55.

[6] *Claus:* Entwicklung, Organization und Systemat. Stellung der Arguliden. Zeit. f. w. Zool., 1875. Zur Kenntniss der Organization und des feineren Baues der Daphniden, etc. Zeits. f. w. Zool., 1876. Zur Kenntniss des Baues, und der Organization der Polyphemiden. Denkschr. d. Wiener Akad. wiss. Math. Naturw. Classe, 1877, XXXVII, 245. Der Organismus der Phronimiden, Wien, 1879, 10.

in the same direction do Sars,[1] Weismann,[2] Rougemont,[3] Gamroth,[4] Hoek,[5] Haller[6] and others more or less decide upon the olfactory nature of the organ of Leydig.

Jourdain (40) does not accept this opinion, and Wrzésniowski[7] adopted the views of Milne-Edward and La Valette. The "calceoli" of Amphipoda might be regarded as organs of smell.

There was still some opposition to Leydig's opinion that in the insects the sense of smell is localized in the antennæ (teeth and pits), and here the work of Hensen[8] might be mentioned, which in 1860 had a decided influence upon the conclusion of some inquiries.

Thus Landois (15) denied that the antennæ had the sense of smell, and declared that the pits in the antennæ of the stag beetle were auditory organs. In like manner Paasch (16) rejected Leydig's conclusion, while he sought to again reinstate the old opinion of Rosenthal as to the olfactory nature of the frontal cavity of the Diptera. In spite of the exact observations and interesting anatomical discoveries of Forel[9] in ants, made in 1874, there appeared the great work of Wolff on the olfactory organs of bees, in which this observer, with much skill and acuteness, sought to give a basis for the hypothesis of Kirby and Spence that the seat of the sense of smell lay in the soft palatine skin of the labrum within the mouth. Joseph (18), two years later, drew attention to the stigmata as olfactory organs, referring to the olfactory girdle, and Forel[10] sought by an occasional criticism of Wolff's conclusions to prove experimentally the olfactory function of the antennæ; but Graber,[11] in his much-read book on insects, defended the Wolffian "nose" in the most determined way, and denied to the antennæ their so often vindicated faculty of smell. In 1879 Berté (52) thought he had observed in the antenna of the flea a distinct auditory organ, and Lubbock[12] considered the organs of

[1] *Sars:* Histoire naturelle des Crustacés d'eau douce de Norvège, Christiania, 1867.

[2] *Weismann:* Ueber den Bau und der Lebenserscheinungen der Leptodora hyalina, Zeits. f. w. Zool., XXIV.

[3] *Rougemont:* Naturgeschichte des Gammarus puteanus, München, 1875, 9.

[4] *Gamroth:* Beiträge zur Kenntniss der Naturgeschichte der Caprellen, Zeits. f. w. Zool., XXXI, 1878.

[5] *Hoek:* Carcinologisches in Tydsehr. d. Md. Dierk. Vereen. Deel, IV, 102.

[6] *Haller:* Der Læmadipodes filiformes, Zeits. f. w. Zool., XXXIII, 1880, 368.

[7] *Wrzésniowski:* Vorl. Mittheilung über einige Amphipoden. Zool. Anzeiger, 466, 1879.

[8] *Hensen:* Das Gehörorgan der Decapoden. Zeits. f. w. Zool. XIII, 1863. Das Gehörorgan von Locusta. Zeits. f. w. Zool. XVI, 1886.

[9] *Forel:* Les Fourmis de la Suisse. Neue Denkschr. Allg. Schweiz. Gesellsch. f. d. ges. Naturw. XXVI, 1874. 118, 144.

[10] *Forel:* Der Giftapparat u. d. Anal-drüsen der Ameisen. Zeits. f. w. Zool. XXX. Suppl. 60.

[11] *Graber:* Die Insekten, München, 1877.

[12] *Lubbock:* On some points in the anatomy of ants. Monthly Micr. Journ., 1887, 121–142.

Forel in the antennæ of ants as a "microscopic stethoscope." In 1879 Graber described a new otocyst-like sense-organ in the antennæ of flies (20) which was accompanied by a complete list of all the conceivable forms of auditory organs in Arthropods. In this work Graber described in Musca and other Diptera closed otocysts with otoliths and auditory hairs, as Lespè had previously done. But Paul Mayer, in two essays (21, 53) refuted this view in a criticism of the opinion of Berté, referring the "otocysts with otoliths" to the well-known antennal pits into which tracheæ might pass. Mayer did not decide on the function of the hairs which extend to the bottom of the pits; while in the most recent research, that of Hauser (22), the author again energetically contended for the olfactory function of the antennæ. Both through physiological experiments and detailed anatomical investigations Hauser sought to prove his hypothesis as Pierret, Erichson, Slater, and others had done before him, besides working from a Darwinian point of view. In a purely anatomical aspect, especially prominent are his discovery of the singularly formed nerve-rods in the pits and peg-like teeth of the Hymenoptera and their development, as well as the assertion that numerous hairs in the pits described by Leydig, Meyer, etc., should be considered as direct terminations of nervous fibers passing into the pits. In the pits he farther, with Erichson, notices a serous fluid, which may serve as a medium for the perception of smells. Among the latest articles on this subject are those of Künckel and Gazagnaire (41) which are entire anatomical, while the latest treatise of Graber on the organs of hearing in insects[1] opposes Hick's theory of the olfactory function of the nerve-end apparatus in the halters, wings, etc., and argues for the auditory nature of these structures. Finally, experimental researches by Voges on the seat of the olfactory organs are only known to the writer by a notice in the "Täglichen Rundschau."[2] According to this observer the sense of smell is not localized, but spread over the whole body.

Coxal Glands in Spiders and perhaps Insects.—Professor P. Bertkau reports that in a specimen of Atypus he has been able to find a distinct efferent duct for the coxal gland; it is surrounded by the same fibrous plexus as the gland itself; in six other specimens the duct was not to be found, though the orifice was seen. This rare phenomenon may either be explained by supposing that there was an abnormal retention of an organ which is in other cases absorbed, or, it may be suggested, that in adult examples the efferent duct is regenerated from time to time, in which case the coxal gland would not be a rudimentary organ, but one that is intermittently functional; the constant presence of the orifice is an argument in favor of the latter hypothesis. It

[1] *Graber:* Ueber die Chordotonalen Sinnesorgane der Insekten. Archiv. f. mikrosk. Anat. XX, 506-640. XXI, 65-145. 1881, 1882.

[2] Tägliche Rundschau. Zeitung für Nichtpolitiker, 1882, September (?).

is important to note that the orifice appears on two segments, for this indicates a repetition of the glandular organ, and is *pro tanto* a support to the view of Ray Lankester, that the coxal glands of Arachnids and of Limulus, are the homologues of the segmental organs of Peripatus. The author suggests that the gland at the sides of the prothorax of *Anisomorphus buprestoides*, and those found by Scudder in the Phasmidæ, are possibly representatives of the same gland. In *Mantis religiosa* there is a coiled gland at the hinder side of the fore leg.—*Journ. Roy. Micr. Soc., June, 1886.*

Heart of Insects.—Miss Olga Poletajura finds that the heart of Bombus is composed of five separate tubes, which form the chambers of the organ, and that the most anterior of these is continued into the aorta. Each tube narrows anteriorly so as to have the appearance of a truncated cone, while the walls become thinner; posteriorly it enlarges; the anterior end passes into the posterior in front, and each anterior end is so flattened laterally as to form a vertical cleft; the cardiac tubes are thus only united with one another at two points; the free portion forms a duct (ostium) by which the blood from the abdomen enters the heart; the internal surface of the anterior tube, and the external surface of the posterior form pouch-like safety-valves which regulate the movement of the blood. The heart of Cimbex is formed in essentially the same way as that of Bombus. The writer points out the differences between the accounts now given and those of such entomologists as Strauss, Newport, and Graber, and describes the mode by which the heart appears to perform its function; contrary to the opinion of Strauss, the first chamber does not function alone, as the propelling agent and the ostia are not perfectly closed, so that part of the blood does return to the abdominal cavity.—*Zool. Anzeig., ix (1886), pp. 13–5.*

Migrations of the Ajax Butterfly.—During the fore part of June, 1886, unusual numbers of the Ajax butterfly *(Papilio ajax)* migrated through this city. Since the only feeding places accessible to them in Chicago at this point are scattered lots where a few bunches of clover or dandelion make up the principal flowering plants, the butterflies made few if any stops at these, but flew along the streets near the ground at a rapid rate northward, and it was with considerable difficulty that a single specimen was secured. On June 12th a visit was made at Wood Lawn, Ill., a few miles south of Chicago, where the butterflies were found quite as plentiful, and showed the same uneasiness in their flight. In a cleared grassy spot in the woods near at hand, white clover had spread its blossoms in broad patches where occasionally a butterfly would make a hasty stop, which, however, was only for a moment, when its form would again be seen disappearing through the woods. One of these specimens, after many futile

attempts was caught, but was badly spoiled and thrown away, which, by mere chance, fell on the ground with its wings extended. A few minutes later it was noticed that the insects that flew by were sensibly attracted by this dead insect, which they endeavored to make known by their occasionally alighting directly upon the dead body of their fellow.

Thus noticing the decoying effects of the insect, a number after being chloroformed were set apart as decoys pinned upon the ends of twigs which were stuck in the ground. The effect was quite remarkable; hardly a single butterfly would pass the sight without alighting among them, and became an easy prey to the net. In this way a large number of beautiful specimens were taken which would otherwise have been quite difficult to capture. —*Joseph L. Hancock.*

ENTOMOLOGICAL NOTES.—At the June meeting of the Entomological Society of Washington, Mr. Lugger mentioned the fact that the seeds of the hard maple, so numerous in the Smithsonian grounds, were this year uniformly sterile. He attributed this phenomenon to the inclement weather during the flowering season, which prevented bees from visiting the flowers. He also farther described the mode of fertilization of the common lady's-slipper *(Cypripedium acaule)* by a species of Andrena. —— Mr. Lugger also remarked that a few specimens of the European *Aphodius erraticus* were first found by him in 1878 near Baltimore. Since that time the species has spread and is now so common that it has actually replaced the formerly common *Aphodius fimetarius.*——Mr. J. B. Smith describes and figures, in Entomologia Americana (No. 4), the scent-organs of *Leucarctia acræa* and *Pyrrarctia isabella*, which are thrust out between the 7th and 8th segments of the abdomen of those moths. Similar organs have been observed by Morrison in *Agrotis plecta* and *Euplexia lucipara*, and Dr. Riley has observed them in *Aletia xylina.*

ZOÖLOGY.

CLASSIFICATION OF SPONGES.—Professor W. J. Sollas (Scientif. Proc. Roy. Dublin Socy., v. 1886) thus arranges the sponges:

Class I. Plethospongiæ.
  Sub-class I. Hexactinellida.
  Sub-class II. Desmospongiæ.
  Sub-class III. Myxospongiæ.
Class II. Calcispongiæ.

The great majority of the sponges, as will be seen, belong to the Desmospongiæ. The Myxospongiæ are not regarded as a degenerate group. Sollas resents (Zool. Anzeiger, 1886) the imputation of Heider that his peculiar gastrulas of sponges were merely shriveled blastulæ.

NEW FRESH-WATER CŒLENTERATE.—Dr. Ussow describes (Ann. and Mag. Nat. Hist., XVIII, p. 110, pl. IV, 1886) a new fresh-water Cœlenterate from the rivers of Russia. It is a Hydromedusa, but differs so from all others that it is made the type of a new genus, Polypodium. The young stages are remarkable in that they are passed as parasites in the eggs of the sterlet, about one-fifth of the eggs being thus infected. This stage is described as a cylindrical spiral twisted tube with numerous lateral buds. This feeds upon the yolk granules which are taken up by the *ectodermal* cells and are thence passed to the endodermal ones. From this is developed the free stage, which is more like a normal Hydromedusa and is provided with six, twelve or twenty-four tentacles, but lacks an umbrella. The perfect or sexual stage is not known. A full paper is promised soon.

NERVOUS SYSTEM OF THE SEA-URCHIN.—M. H. Pronho states that if one suitably treats a portion of the integument which covers the test of *Echinus acutus* with chloride of gold or citric acid, numerous bluish lines connected by frequent anastomoses will become apparent; the appearance forcibly recalls that figured by Professor Loven of the peripheral nervous system of *Brissopsis lyrifera*. Examined under a power of 500, the plexus will be found to consist of a large number of fibrils, and some of the principal bundles will be seen passing towards the spines and adjacent pedicellariæ. The fibrils of which this plexus is formed are identical with those of the tentacular and ambulacral nerves, and each is continuous with the fiber from the ambulacral nerve which emerges from one of the tentacular pores; the plexus lies between the external epithelium and a layer of connective tissue which sends off a number of connective bands through the meshes of the nervous plexus to support the epithelium. At the base of each spine there is a relatively well-developed nervous ring. The cellular elements of the plexus are very difficult to detect in the plexus, but they are very numerous and easy to see in the nerve-ring; the author does not, however, agree with M. Romanes in his description of these elements. M. Pronho has also been able to make out a nervous genital ring, which connects the five genital glands with one another and, by means of the five ambulacral trunks, with the peribuccal nervous pentagon. —*Comptes Rendus, cii (1886), pp. 444-6.*

THE CRUSTACEAN CARAPAX.—There seems to be a certain fatality connected with some scientific facts. Away back in 1834 the late Henri Milne-Edwards had a conception of the true morphology of the crustacean carapax, and eighteen years later James D. Dana still further elaborated the matter. But, notwithstanding the weight of their authority, their views failed to gain general acceptance and almost every text-book[1] to-day states that the

[1] Dana's view was adopted by Packard twenty years ago, and is taught in his text-books and lectures.

carapax of crabs and lobsters represents the coalesced terga of all the cephalic and thoracic segments, and a line crossing it is pointed out as the suture dividing the head from the thorax—the cervical suture. This view is wholly erroneous and has arisen from an attempt to trace homologies where none exist. Dr. Howard Ayers (Bulletin Essex Institute, Vol XVII, pp. 49–59, pls. II–III, 1886) has recently restated the problem and the evidence to show that the carapax is in reality to be regarded as the coalesced terga of the antennal and mandibulary segments, and that the "cervical suture" merely indicates the line between them. His presentation of the case should be conclusive. He further shows that the parts regarded by Milne-Edwards as episterna are in reality portions of the sternum cut off by the appearance of false sutures.

DEVELOPMENT OF PHYLLOPODS.—Claus, in the last Heft of the sixth volume of the Arbeiten zool. Inst., Wien, gives an account, illustrated with twelve plates, of the structure and development of the Phyllopod genera Branchipus and Artemia, which supplements his former paper published in Göttingen, 1873. He discusses the segmentation and development of the body during metamorphosis, the segmentation of the mesoderm and the differentiation of the ectodermal and mesodermal organs, the formation of regions and the number of segments, integument, connective tissue and fat bodies, muscles, nervous system and sense organs (including the median and lateral eyes), the alimentary and excretory organs, heart, circulation and respiration, and the sexual organs, thus giving a monographic treatment of the development of the group.

THE RIBS OF SPHENODON (HATTERIA).—Cope[1] has shown that in some of the Pelycosauria the capitulum of the two-headed ribs is attached to the intercentrum.

The question arose immediately: Is it not probable that the living Sphenodon with so many characters common to the Permian Pelycosauria shows the same condition?

The ribs of Sphenodon are described by Owen, Günther and Albrecht. None of these authors speak about ribs connected with the intercentrum (hypapophysis), but they have observed two-headed ribs in the cervicals.

Owen[2] says: "The fourth vertebra has a short pleurapophysis on each side with a bifurcate proximal end articulated by a broad tubercle to the diapophysis and by a slender neck and head to a

[1] Cope, E. D. Description of Extinct Batrachia and Reptilia from the Permian formations of Texas. Palæontol. Bull. No. 29, p. 518. Amer. Philos. Soc., April 5, 1878.

The Relations between the Theromorphous Reptiles and the Monotreme Mammalia. Proc. Amer. Assoc. Advanc., Sc., Vol. XXXIII, Philadelphia meeting, September, 1884.

[2] Descriptive Catalogue of the Osteological Series contained in the Museum of the Royal College of Surgeons of England. Vol. I. London, 1853, p. 142.

rudimental parapophysis, but this is very feebly marked off from the diapophysis. In the fifth vertebra the parapophysis and diapophysis form together an oblique ridge, chiefly extended vertically, and to which the expanded head of the pleurapophysis articulates by a single surface."

Günther[1] says: "In one example the pleurapophysis of the fourth vertebra is not bifurcate, the lower branch being replaced by a ligament, and no trace of a parapophysis can be distinguished."

Albrecht[2] says: "Quatrième vertèbre cervicale.—Diapophyses bien développées et séparées par une échancrure d'un rudiment de parapophyse. Tubérosité de la côte également bien développée et séparée aussi par une échancrure du col de la 4^{e} côte cervicale. La diapophyse articule avec la tubérosité de la dite côte, tandis que le rudiment de parapophyse est réuni par un ligament au col. Nous avons donc ici une combinaison des cas de Owen et de Günther."

According to all these authors the first rib appears on the fourth vertebra.

My own examinations made on two alcoholic specimens of Sphenodon, show the following:

First vertebra (atlas). — Single headed *ligamentous* ribs connected with the distal part of first intercentrum (between occipital condyle and atlas).

Second vertebra (axis). — Two-headed *ligamentous* ribs. Capitulum connected with distal part of second intercentrum (between atlas and axis); tuberculum connected with a small diapophysis of the vertebra.

Third vertebra.—First specimen, two-headed *ligamentous* ribs; second specimen, two-headed osseous ribs. Capitulum ligamentous connected with small process (parapophysis) on the posterior lateral part of third intercentrum, tuberculum connected with diapophysis.

Fourth vertebra.—Two-headed osseous ribs. Capitulum well developed but not entirely ossified, the proximal *ligamentous* part connected with the process (parapophysis) of fourth intercentrum, tuberculum attached to the well-developed diapophysis.

Fifth vertebra.—One-headed osseous ribs. Capitular part *rudimentary* and *ligamentous*, connected with fifth intercentrum, tuberculum well developed, attached to a short but broad diapophysis.

All the other cervical and dorsal vertebræ show the same condition as the fifth cervical.

Albrecht[3] believes that the diapophysis of the fifth and the

[1] Günther, A. Contribution to the Anatomy of Hatteria (Rhynchocephalus Owen). Philos. Trans., Part I, for 1867, p. 11.

[2] Albrecht, P. Note sur la présence d'un rudiment de Proatlas sur un exemplaire de *Hatteria punctata* Gray. Bull. Mus. Roy. d'Hist. Nat. Belg., Tome I, 1883, pp. 190–191.

[3] Albrecht, loc. cit., p. 190.

following vertebræ represents a *paradiapophysis* and the head of the rib a *capitulo-tuberculum.* I believe that the diapophysis consists of *diapophysis* only, and that the head of the rib represents only the tuberculum,[1] the capitulum being distinct but ligamentous.

The living Sphenodon shows therefore in principle the same condition of the rib-articulation as the Permian Pelycosauria. But there are still other Sauropsida which have some of the ribs connected with the *intercentrum.* In all Crocodilia and Dinosauria the first rib of the atlas is attached to the *intercentrum* between the occipital condyle and the atlas. The same condition can be found in birds, where this first rib has become ligamentous, and probably in all Sauropsida with ribs connected with the Atlas.

I do not doubt that the Ornithosauria show the same condition, since L. v. Ammon[2] has shown that the cervical ribs of Rhamphorhynchus are like those of the crocodile.—*Dr. G. Baur, Yale College Museum, New Haven, Ct., Sept. 19, 1886.*

Birds killed by electric light towers at Decatur, Ill.—I enclose a slip cut from the Decatur Republican of last evening; also a list of birds brought to me yesterday by boys from different parts of the city, as determined by Professor J. H. Coonradt of our High school. Some of them are seldom seen in this neighborhood, so far as my observation goes. Indeed, most of them are rarely noticed in the city this time of the year. I think none were found under the lamps this morning. From the numbers I saw and heard of yesterday I should think it probable that a thousand birds were killed around the electric light towers which light our town. I suppose this is not an unusual occurrence, but as the numbers were so great I thought possibly you would like to make a note of it.

Following is the list of the birds killed by the electric light towers: Redstart (*Setophaga ruticilla*), red-breasted grosbeak (*Goniaphea ludoviciana*), indigo bird (*Cyanospiza cyanea*), black and yellow warbler (*Dendræca maculosa*), house-wren (*Troglodytes ædon*), Maryland yellow-throat (*Geothlypis trichas*), Acadian flycatcher (*Empidonax acadicus*), scarlet tanager (*Pyranga rubra*) cat-bird (*Galeoscoptes carolinensis*). olive-backed thrush (*Turdus swainsoni*).—*E. A. Gastman, Decatur, Ill., Sept. 29, 1886.*

Zoological News.—*General.*—M. Zarondnoi (Bull. Mosc. Soc. Nat.) enumerates 184 species of birds in the Trans-Caspian fauna. He divides the district into three sub-regions, (1) the Kara-Kum desert, (2) the Akhal-Tekke oasis, (3) the mountains. The first district has a pretty well furnished flora, spite of its immense

[1] The same condition exists in the Lacertilia, Pythonomorpha, and Ophidia.

[2] Ammon L. v. Ueber das in der Sammlung des Regensburger naturwissenschaftlichen Vereins auf bewahrte Skelett einer langschwaenzigen Flugeidechse Rhamphorhynchus longicaudatus, Correspondenzblatt des naturwissenschaftlich. Vereins in Regensburg, 38 Jahrgang, 1884, p. 155.

sandy plain and salt clays. The reptiles of this sub-region, which extends into the Akhal-Tekke oasis, are, of lizards, two species of Phrynocephalus, *Agama sanguinolenta* and *Varanus scincus;* a Testudo, and the snake *Naja oxiana.* This oasis has a most monotonous landscape, but is pretty well furnished with insects, among them Julodis (3 sp.) several kinds of Ateuchus and Copris, and numerous Melanosomata. Jackals, and on the banks of the few rivers the wild cat and the Lagomys occur. The summer in this oasis is very hot; 40 Celsius in the shade is not uncommon. The summer molting of the birds is by our author attributed to this great heat. The lark has parts of its body quite bare at that season. The bulk of the birds of the oasis during the summer belong to the Aral-Caspian fauna, but others come from the mountains, following the rivers. Griffons, ravens, swifts and swallows live in the mountains, but descend to the plain to hunt. In the valleys of the mountains the leopard and the cheetah are rare, *Hyæna striata* is occasional, and *Ellobius talpinus,* several species of Erinaceus and Platycercomys and *Hystrix hirsutirostris* are common. The dreadful *Vipera eufratica* is a source of continual danger during the grape harvest of the forested upper valleys.

Protozoa.—Gruber has been studying the phenomena of conjugation as presented by Paramecium, and states that not only is there a union of the nuclei, but that the nucleoli "come into intimate contact, copulate with each other." He claims that the act has not only a sexual function but it plays a part in rejuvenescence, and that there is an exchange of protoplasm between the nucleoli.

Rhizopoda.—Mr. Whitelegge enumerates twenty-four species of Rhizopoda in New South Wales, mostly identical with those found in Europe, America and India. The list includes *Pelomyxa palustris, Rhaphidiophrys elegans, Clathrulina elegans,* and *Biomyxa vagans.*

Cœlenterates.—Mr. G. H. Fowler (Quart. Jour. Mic. Soc.) describes the anatomy of two species of madrepores. *M. durvillei,* has four features in common with the Alcyonaria: (1) a tendency to absence of polyps on the ventral side of the branches; (2) the very definite orientation of the polyps; (3) the differentiation of the mesenteries; (4) the distinct dimorphism.——Nothing has hitherto been known of the development of the Cubomedusæ. Haacke publishes in the Zool. Anzeiger (IX, p. 554) some notes on the development of an Australian Charybdea in which he shows that Haeckel was probably correct in his supposition that there was an alternation of generations in these forms. He also gives notes upon the development of the sense organs and phacellæ and states that the velar canals are at first unbranched. The umbrella at first is pyramidal, much like that of the Scyphostoma forms, and only later does it attain the cubical form characteristic of the

adult.——W. L. Sclater describes (Proc. Zool. Soc., 1886) a fifth species of deep-sea coral of the genus Stephanotrochus. It comes from the British seas and was dredged at a depth of 570 fathoms. Some notes are given of its anatomy.

Vermes.—Mr. W. B. Benham (Quart. Jour. Mic. Soc.) first gives a condensed historical review of the various works on earthworms, and a chronological record of the discovery of new facts; then briefly enumerates and describes all known earthworms; then takes the various organs in order, and points out their variations, and lastly describes some new species. Among these is *Microchæta rappi* from South Africa, a worm three feet six inches long, and therefore comparable with Antæus and Titanus from South America. Another species of Microchæta from Natal follows, and is succeeded by Urobenus (1 sp.), Diachæta (1 sp.), and Trigaster (1 sp.) all new genera.——Mr. Weldon contributes to the same journal an account of *Dinophilus gigas*, found at Penzance, England. Three species of the genus were previously known. Dinophilus is stated on the one hand to be related to the Archannelids, while on the other it retains many features characteristic of the common ancestor of these groups, in which Mr. Weldon includes Crustacea, Mollusca and Rotifera, as well as Chætopoda and Gephyrea. The relations of the body cavity, excretory system and pharynx point to a Turbellarian origin.——The tapeworm, *Tænia filicollis*, has been known as a parasite of the sticklebacks (Gasterosteus). Dr. Leidy now reports it from specimens of Amia from North Carolina, though there is some doubt as to whether it was really parasitic in these fishes.——E. A. Rau reports four cases of trichinosis at Bethlehem, Pa., in the early part of the present year, two of which resulted fatally. All were caused by eating from the same infected pork.——Kennel, in the last "Heft" of "Semper's Arbeiten," completes his account of the development of Peripatus. He differs greatly on many points from Sedgwick's account of the embryology of the species of the same genus from the Cape of Good Hope.

Arthropoda.—J. J. Quelch has announced (Nature, July 29, 1886) that a Peripatus, apparently *P. edwardsii*, is found in the Demerara division of British Guiana. An example which, when not elongated, is about three and a half inches long, has thirty-one pairs of feet, the last three of which it rarely puts to the ground except when it goes backward. It frequently discharges a viscid secretion when handled. Mr. Im Thurm previously found small specimens in Essequibo.——According to observations made by M. G. St. Remy upon the brains of *Scolopendra morsitans* and some other myriapods, the Myriapod brain is simple and approaches that of Crustacea.——M. Trouessart (Comptes Rendus, July, 1866) notes the presence, within the upper part of the shaft of the feathers of a curlew shot in the winter, of several Mallophaga of the genus Colpocephalum. The hole by which these insects

entered was placed upon the lower side of the feather, in the furrow, about two centimeters from the upper umbilicus. The insects were dead, and were accompanied by the empty shells of the eggs they had laid, with a few ova which still contained embryos. A hole about five millimeters from the lower umbilicus was apparently the outlet of the larvæ. The interior of the soft portion of the feather had been devoured. It is not yet ascertained what conditions determine these devourers of feathers to seek refuge within the quill. Acaridæ, Syringophilus and other genera have before been found within the shaft, but these seem to enter by the upper umbilicus.——Houssay has been studying the arterial system of the scorpion (Comptes Rendus, Aug. 2, 1886, p. 354). The greatest interest centers in his description of the sternal artery which ensheathes the nervous cord almost exactly as it does in Limulus, thus affording additional evidence in favor of the view held by Van Beneden, Lankester and Kingsley, that the king crab is closely related to the spiders.——Winckler having recently announced that he had found a heart in the Gamasid mites, and that it could be studied through the transparent integument of the living animal; Kramer calls attention to the fact that he announced the same in the Archiv. für Naturgeschichte for 1876.——Brady gives a list (Proc. Zool. Soc., 1886) of all the known Entomostraca of South Australia, and adds several new species to the number.——Beddard, in the same journal, completes his preliminary account of the *Challenger* Isopoda.——Frenzel thinks the "Mitteldarmdruse" (the so-called liver) of the Crustacea has the function of a digestive gland which shows in its physiological action, great similarity to the pancreas of the Vertebrata.——Another "fossil myriapod" must go, it having been discovered that "Trichiulus" was based upon a fern.

Mollusca.—M. Th. Barrois gives in his thesis before the Faculty of Sciences of Paris an account of the foot-glands and aquiferous pores of the lamellibranchs. There is great variety in the byssus-forming apparatus, but *Cardium edule* furnishes a good typical example. The byssus is a glandular product, and does not consist of dried or chitinized muscular fibers. *C. edule* has a simple byssus of one filament, while Lima, Pinna, and Avicula have many. In Arca the filaments are united into a mass, and Anomia has a similar mass which is encrusted with calcareous salts, so as to appear as an ossicle. M. Barrois describes the muscles of the byssus; the cavity of the byssus, which receives the secretion; the glands of the cavity; the byssal canal; the groove, and the glands of the groove. In some species every vestige of the byssal apparatus has disappeared (*Solen ensis*, etc.), while other forms show a partial disappearance. The mucous glands are sometimes scattered over the foot, but more often they are localized in the free anterior extremity; while in Lima, Pecten, and Anomia they discharge into a furrow. It has often been argued that the rapid

increase and diminution of size observable in the foot must be caused by the presence of aquiferous pores which permit water to enter into the circulation, but M. Barrois has searched in vain for such pores.——M. Giard has discovered a new species of Entoniscus (*E. mænadis*) upon a female *Carcinus mænas* obtained at Wimereux. It was situated upon the left side of the animal, in the midst of the hepatic cæca.——The question why the scallop, Pecten, is so abundantly supplied with eyes has often been asked and has never received a satisfactory answer. Dr. Benjamin Sharp now states that these organs are really phosphorescent and that as the production of light would be of advantage to the animal this may possibly explain their abundance.——W. D. Hartman adds new difficulties for the students of conchology by describing several more "species" of the much-abused genus Partula of the South Seas. There is now not much choice between Partula or Achatina and our own Unio.——Heilprin reports a remarkable instance of vitality in a marine mollusk. Specimens of *Ilyanassa obsoleta* lived for a year removed from salt-water, and for several months of this time they were placed in close proximity to a heated wall where certainly the conditions were not favorable for them.

Fishes.—Dr. Paul Albrecht, formerly of Brussels but now of Hamburg, notes the occurrence, in an example of *Protopterus annectens* in the Konigsberg Museum, of a pectoral member (the right), which is forked at the distal extremity. Above this divided fin are two small outer gills, while there is but one above the left pectoral. Dr. Albrecht considers the dorsal division as the ulna, the ventral as the radius.——H. H. Giglioli sends to Nature an account of the capture of a specimen of *Mullus barbatus* which by some means had become tightly encased in a large colony of *Pyrosoma atlanticum*. The head of the fish had reached the bottom of the social cylinder, and only about a fourth of its length projected posteriorly. It was taken alive.

Reptiles.—Messrs. Mitsukuri and Ishikawa (Quart. Jour. Mic. Soc.) report as a general result of their studies of the formation of the germinal layers in the Chelonia, that the development of the Reptilia harmonizes completely with that of Batrachia.

Birds.—Some remarkable birds of paradise have been recently described by Dr. Finsch and Dr. Meyer (Zeitsch. Ges. Orn. II, pp. 369–391). Among them is *Paradisornis rudolphi* with blue wings and blue flank-plumes. These novelties were discovered by Mr. Hunstein in the Astrolabe range of New Zealand. Mr. Forbes has since collected most of Mr. Hunstein's species, and also a Melithreptes and a Pseudogerygone which seem to be new. Mr. Forbes' birds of paradise, gathered in the rainy season, show the molts and changes of plumage of these birds.——M. M. Charbonnel-Salle and Phisalix have studied the so-called "milk"

with which pigeons feed their young and find that it is not a glandular secretion (as is the material with which the Callocalia constructs its edible nests), but is a formation of modified epithelial cells. This material is produced in the œsophagus of both the male and the female parents until about the twentieth day after the eggs have hatched.

EMBRYOLOGY.[1]

WHY DO CERTAIN FISH OVA FLOAT?—In a recent paper, by a Mr. Prince (Ann. and Mag. Nat. History, 1886), his readers are informed that the buoyancy of certain fish ova is not due to the presence of drops of oil in the yolk as supposed by Ryder, or words to that effect. Had my conclusions not been so summarily disposed of by one whose information is clearly not very accurate or extensive, the writer would not trouble himself to reconsider the subject of the buoyancy of fish ova. In my Embryography of Osseous Fishes (p. 118), I have stated that "the buoyancy of the cod's egg is undoubtedly due to the diminished specific gravity of the protoplasmic matter of the vitellus, and not to the presence of any oils. In this respect it represents an unique type of the buoyant ovum." This statement, published in 1884, but written in 1882, is essentially the same as that of Mr. Prince, published in 1886. Comment is unnecessary.

There are several types of buoyant ova. These are: (1) Those in which the specific gravity of the yolk is diminished, as in the egg of the cod; (2) those in which large oil-drops in an eccentric position aid in causing the eggs to float; (3) those in which a very large oil-drop caused the ovum to float even in fresh water.

These three categories are also, in all probability, connected by intermediate kinds; that is, amongst forms of the second series there are some which are buoyant in water with as low a specific gravity as 1.014, while others are not buoyant in water of less specific gravity than 1.025, while those in which the proportion of oil to plasma is very great, or about as 1 to 7, are buoyant in water with a specific gravity of very nearly 1.000, or in that which is fresh.

As a rule, the buoyant ovum has the oil gathered into a single drop embedded in the vitellus nearly opposite the germinal disk; there seem to be few exceptions to this rule. There are also but very few species known which have buoyant ova without an oil drop, and these are buoyant only in water of rather high specific gravity. Furthermore, as a rule, fish ova which are buoyant are not adhesive, but float about near the surface singly; the most noteworthy exception to this rule is presented by the great pelagic egg-ribbons of Lophius.

[1] Edited by JOHN A. RYDER, Biological Department, Univ. of Penna., Philadelphia, Pa.

The great majority of species of both fresh and salt water fishes, which have heavy, subsident ova containing oil, have their eggs provided with thick, heavy membranes, which are adherent to each other or to foreign bodies, or to both. Furthermore, their egg-membranes are usually adhesive, with the oil-drops scattered beneath the surface of the vitellus, or aggregated in a flat, discoidal group beneath or alongside of the germinal disk, and not very transparent. The whole egg is also usually more or less colored or granular. The egg-membranes of those species which have buoyant ova are, on the other hand, characteristically thin and delicate, so that it is difficult, if not impossible, to make out the presence of pore canals, while the whole egg is, as a rule, remarkably transparent.

These characteristics seem to show that the buoyant ovum is a very well-defined and specialized type, which has been developed in the course of the struggle for existence to serve a very useful purpose in insuring the protection and survival of the embryo during the hatching period.

There are fresh-water forms, also, which have buoyant ova, as in the case of *Macropodus venustus*, in which the proportional volume of the oil-drop is greater than in any other known type. The oil in this case when liberated at once floats at the surface, as does the egg when entire, while the plasma of the germ and vitellus at once sinks. This fact, it seems to me, finally and conclusively proves that the pelagic or buoyant habit of many fish ova is due to the presence of oil aggregated, as a rule, at the vegetative pole of the vitellus in the form of a single drop. The other conditions are (1) that the egg be free and not adhesive, with a thin membrane, and (2) that it be immersed in water having a greater density than 1.014. The one notable exception to the last part of this general statement, viz., Macropodus,[1] it seems to me, serves to show that the presence of oil is very important, and may exceptionally be the sole cause of the buoyancy of the egg.—*John A. Ryder.*

THE ORIGIN OF THE PIGMENT-CELLS WHICH INVEST THE OIL-DROP IN PELAGIC FISH EMBRYOS.—During the past summer, in observing the development of the common mackerel, *Scomber scomber*, I noticed that pigment cells began to appear on the innermost side of the oil-drop before the tail of the embryo had become prominent. Noting the condition of the oil-drop, and its relation to the surrounding structure, it was noticed that a thick layer of protoplasm invested it. This investing layer of protoplasm, it was also observed, was absolutely continuous, with the layer of periblast enveloping the yolk. Consequently, the only source from whence the nuclei of the pigment cell surrounding

[1] For an opportunity to study the development of this form, I am indebted to my friend Wm. P. Seal.

the oil-drop could have been derived was the periblast. That layer being hypoblastic, so far as its morphological relations are concerned, it follows that the pigment cells which are developed around the oil-drop in Scomber, Scomberomorus, Chætodipterus, etc., arise from the hypoblast.—*John A. Ryder.*

Life History of Thalassema.[1]—This very useful memoir deals with a type, the phyletic history of which is very obscure. The author concludes that Thalassema is an Annelid in which simultaneously with the lengthening of the alimentary canal, there has been a suppression of metameric segmentation. The ova are developed from free plastids, which become detached from the peritoneum, and float about in the perivisceral fluid, in which they grow to maturity. The eggs when discharged are buoyant; undergo a total and equal segmentation, accompanied by the expulsion of two polar globules; the first one of these finally undergoing subdivision into two. An invaginate gastrula is formed, which elongates as the stomach is formed; the latter is then subdivided by three constrictions, bends upon itself, and finally unites with the body-wall, and the anus breaks through at a point corresponding to one end of the blastopore, which has, in the meantime, become elongated. The embryo, at first covered by cilia, finally developes preoral, postoral and perianal ciliary girdles, and thus becomes a trochosphere. The ectoderm opposite the gastrula mouth becomes thickened to form the beginning of the nervous system, the second part of which is developed later as a ventral ectodermal thickening, occupying the position of the closed lips of the lengthened blastopore. The muscular system arises from two mesodermal bands near the anus, which grow forward and become segmented. In the course of further growth the segmentation disappears, the preoral lobe becomes filled with muscular tissue, the setæ appear as mesodermal organs, the anal pouches arise as ectodermal invaginations, and finally admit, through their internal openings, a large quantity of water into the body cavity, which causes the animal to increase much in size.

The larva finally finds its permanent home in some cavity in a sand-dollar shell. Here, by means of its preoral lobe, which has now become long, flexible and muscular, and by the aid of secretions from dermal glands, it arranges for itself rough chambers in the sand with which the shell is filled. In this chamber it remains a prisoner. Here it grows to maturity, completely secure from external attack. Its only means of communication with the exterior is through the small oral opening of the sand-dollar shell, and through this it must obtain all its food and cast its sexual products when mature.

The speculations of the author as to the origin of irregular seg-

[1] H. W. Conn. Studies from the Biolog. Lab. Johns Hopkins University, III, No. 7, pp. 351–401, pls. XX–XXIII, 1886.

mentation (on page 370 and *infra*) do not seem to the reviewer to be borne out by the facts. On page 373 he says: "The object of food-yolk, as is well known, is to enable the young to abbreviate its development by having its food supplied, and being consequently able to skip some of its ancestral stages." Instead of this being the fact, exactly the reverse is true, as has been shown by Balfour, Cunningham and myself.—*John A. Ryder.*

PHYSIOLOGY.

SOME NOTES ON RECALCIFICATION OF HUMAN TEETH.[1]—The extent to which human development depends upon the proper utilization of food is such that any fact bearing upon the success of this process becomes of paramount importance.

Living in a section of country where diet and drink are unusually deficient in calcific elements, my attention was many years ago called to the analogous condition of the teeth of children in that region, which, as a rule, are characterized by a corresponding deficiency in calcific elements.

Rapid and remarkable changes also occur in the condition of the teeth of adults—almost in direct ratio to their changes of environment in this respect. The "baker's bread" and other food products in most general use by the inhabitants of the region near the Gulf of Mexico, and more especially by the inhabitants of cities, are largely divested of calcific elements, while the water used for potable purposes is almost exclusively rain water, which, though a good solvent, contains no mineral elements.

The wonderful power of adaptation possessed by our race is such that people, living in this region for a number of generations, acquire the power of appropriating, from the meager supply thus furnished, the necessary elements to produce fairly good teeth; but the very large number of residents, not natives of this section, whose early life and the life of their ancestors, has been spent in regions where calcific elements were more abundant, and whose constitutional habit was accustomed to that abundance, are not able to assimilate, out of this meager supply, the requisite proportion of limesalts.

The function of nutrition being dual in its character—removing effete and worn-out material on the one hand, while supplying the elements to maintain the integrity of the tissues on the other—the calcific elements, which form the inorganic basis of tooth-substance, and which rendered the teeth hard and firm, are carried away, while the supply to rebuild, being deficient in quantity, the corresponding amount is not restored, the teeth in consequence soon become decalcified and softened, falling an easy prey to unfavorable conditions.

[1] Read before Sections F and H in joint session, Buffalo Meeting A. A. A. S., August, 1886.

The fact of decalcification has long been recognized in the proverb concerning mothers: "For every child a tooth," not, however, that the material of the mother's tooth is absolutely taken away to build up those of the child, as was once taught, but that the increased demand for building material not being met with increased supplies sufficient to meet the demands of both mother and child, the teeth of the former suffer the consequences of lack of supplies.

The rapid decalcification thus occurring, is not a breaking down of the organic structure, and, if the material necessary to recalcify, is provided in a form which nature can appropriate, this softening may be prevented, or teeth which are already softened may be rendered hard and durable.

Observing these phenomena—this softening of teeth in persons coming from regions where good teeth are the rule, and the recalcification following their return to their old homes—led me to investigate the relations between environment and the development of teeth.

A careful observation of these phenomena not only showed the utter fallacy of the old *dictum*, that the teeth were subject to no changes after maturity, but also showed that there must be a system of circulation throughout the entire substance of the tooth, making this action of the nutrient function possible during the whole life of the tooth.

The fact of decalcification and recalcification, and continued nutrient action during life, being established by long observation, suggested the study of the best modes or methods of aiding nature in the work of recalcification.

Any possible change from ordinary diet, was found, as a rule, entirely inadequate; the natural suggestion of the direct administration of the phosphates—the chief inorganic elements in tooth substance—also proved entirely unsatisfactory, and led to the recognition of the truth that "nature will not take the elements from any ready-made source, but must elaborate her own pabulum."

Noting that the recalcification observed in the teeth of those visiting favorable regions was *not* due to the use of lime in the shape of phosphates, and that the difference between the nutrient elements of these same people, whether in the mountains or in the lowlands, lay more largely in the water they drank than in the food they ate, suggested the administration of aqua calcis; and this was followed by results as eminently gratifying as the use of the phosphates had proved unsatisfactory.

A new preparation of lime, in the form of a syrup of calcis, of much greater strength than the aqua calcis, and proportionately more prompt in its action and effects, has proved still more gratifying in its results.

An extended experience of many years has proved that by this

means it is not only possible to *restore* soft, decalcified teeth of all ages, but to *prevent* their decalcification, and also to forestall defective calcification of children's teeth, and even to improve the original type; so that we are now able to overcome not only bad environment but even bad heredity also.

Running *pasi passu* with my study and observations on the investigations of the microscopical histologists, the discoveries of McQuillen, S. P. Cutler, Carl Heitzman, Bodecker, Frank Abbott, A. H. Thompson and others, have demonstrated the existence of the system of nutrition, which, reasoning *a posteriori*, I assumed and announced many years ago.

The living fibrillæ radiating through the dentinal tubuli; the osmotic action between cementum and dentine, and dentine and enamel, and *vice versa*, the circulating currents through the areas of living matter between the enamel rods and prisms are, to-day, admitted histological facts, demonstrated by the microscope.

The tooth is raised to the dignity of a living organ, with a circulating system, carrying pabulum to all its parts to supply the hunger of its needy tissues.

A knowledge of these facts, and of the best methods of supplying material to maintain the integrity of the dental tissues, or of restoring those whose integrity has been impaired, is destined to have a far more important bearing upon human welfare than any degree of skill in operative or prosthetic oral surgery.—*J. R. Walker, D.D.S.*

ANTHROPOLOGY.[1]

FOLK-LORE.—The study of folk-lore may now be said to have passed through the collector stage and to have begun to assume the shape of a science. It was very much so with stone implements. Not many years ago a man who had a large collection of arrow-heads and such things was called an archæologist. But we now call by that name the men who utilize these things to spell out the history of human industry and invention. Folk-lore is to human knowledge, belief, literature, what the stone age is to the iron age. At first a folk-lorist was a man who collected songs, tales, legends, sayings, or who recorded the customs of agraphic peoples; he is now one who arranges these in order to find their law of being.

The folk-lorists of England have been wrestling for the last three years with the following questions:

1. The definition, the inclusions and exclusions of the term *folk-lore*.
2. The establishment of classific concepts for the material included. It is very easy to say, put things together that are alike; but it is most difficult to settle upon that characteristic of likeness which will combine our examples into what may be called natural genera, species etc. Connected with this idea of classific concepts is the associated one of terminology.
4. The anatomy of tales, customs, practices, etc., and the invention of a glossary of their organic parts, their *dramatis personæ*, their essential incidents.

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

In Vol. III of the Folk-lore Journal (pp. 1–16), Mr. G. L. Gomme undertakes to answer these questions. He had previously (in Vol. II, pp. 285, 311) advocated a systematic effort of folk-lorists in the same direction. A few definitions are given below to indicate the mental drift of the gentlemen interested:

"Folk-lore is anthropology dealing with primitive man" (Alfred Nutt).

"Folk-lore is anthropology dealing with the psychological phenomena of uncivilized man (meaning unlettered as well as savage), and embraces both folk-thought and folk-wont (practice)" (E. Sidney Hartland, Folk-l. J., II, 340).

"That portion of anthropology which deals with the psychological phenomena of primitive man" (C. Staniland Wake, Folk-l. J., II, 345).

"Folk-lore is the unwritten learning of the people. Folk-lore is not a science, it is the thing itself. One of the chief objects of the collection and arrangement of the facts of folk-lore is to generalize and philosophize, but the generalizations which we arrive at will not be folk-lore" (Henry B. Wheatley, Folk-l. J., II, 347).

"Folk-lore deals primarily with the survival of primitive customs and beliefs among civilized races, and is comparable with, not identical with, the living primitive customs and beliefs of savage races. The sanction back of folk-lore is tradition. Folk-lore is the science which treats of the survivals of archaic beliefs and customs in modern ages" (G. L. Gomme, l. c. III, 14).

"Folk-lore, 'the folk's learning,' all that the folk believe or practice on the authority of inherited tradition, and not on the authority of written records" (Charlotte S. Burne, Folk-l. J., III, 103.

"Folk-lore is the science which has for its object the study of indifferentiated or anonymous humanity, from an epoch which may be considered its infancy down to our own day" (Antonio Machado y Alvarez, Folk-l. J., III, 113). [This whole essay must be read. One cannot afford to omit a sentence.]

"Folk-lore is knowledge of folk-life, or the life of the uncultured classes, as distinguished from culture-lore, knowledge of individualized life, the life of the cultured classes; and the generalizations arising from these two knowledges, or the sciences of folk-life and of culture-life are complementary and mutually corrective divisions of the same mental and moral sciences, the historical sciences, namely, or mental development and of civil progress" (T. S. Stuart Glennie, Folk-l. J., IV, 75).

We come now to the second series of questions, the subject of classific concepts, the study of "What should go where," as Miss Charlotte S. Burne happily puts it.

Mr. E. Sidney Hartland divides folk-lore into two departments, *folk-thought* and *folk-practice*, or still better *folk-wont*. I like folk-wont better, for the reason that folk-lore does not so much include

practice. For instance, I may tell you how an arrow-maker or potter produces his wares, and do it so graphically that a mechanic may counterfeit them. But I have omitted the thousand and one dispensables which the lowly artisan considered indispensable, leaving them for the folk-lorist to glean.

Folk-lore is thus divided:

I. FOLK-THOUGHT.
1. Tales of all kinds, sagas (world-god, hero, elf, ghost-sagas, etc.), nursery tales, drolls, cumulative tales, apologues.
2. Folk-songs; 3. Weather-lore; 4. Proverbs; 5. Local and personal saws and prophecies; 6. Riddles; 7. Folk-speech.

II. FOLK-WONT.
1. Worship, every practice designed to propitiate the powers influencing man's destiny.
2. Folk-law; 3. Folk-leechcraft; 4. Games; 5. Folk-craft.

Mr. Gomme gives the following scheme:

1. *Traditional narratives:*
(a) Folk-tales.
(b) Hero-tales.
(c) Ballads and songs.
(d) Place legends.

2. *Traditional customs:*
(a) Local customs.
(b) Festival customs.
(c) Ceremonial customs.
(d) Games.

3. *Superstitions and beliefs:*
(a) Witchcraft.
(b) Astrology.
(c) Superstitions, practices and fancies.

4. *Folk-speech:*
(a) Popular sayings.
(b) Popular nomenclature.
(c) Proverbs.
(d) Jingle rhymes, riddles, etc.

This is amended by Miss Charlotte S. Burne as follows:

Group 1. *Traditional narratives:*
Class a. Folk-tales.
" b. Hero-tales.
" c. Ballads and songs.
" d. Place legends and traditions.

Group 2. *Superstitions, beliefs and practices:*
Class a. Goblindom.
" b. Witchcraft.
" c. Astrology.
" d. Superstitions connected with material things.

Group 3. *Traditional customs:*
Class a. Local customs.
" b. Festival customs.
" c. Ceremonial customs.
" d. Games.

Group 4. *Folk-sayings:*
Class a. Jingles, nursery rhymes, riddles, etc.
" b. Proverbs.
" c. Old saws, rhymed and unrhymed.
" d. Nick-names, place rhymes and sayings, folk-etymology.

Mr. J. S. Stuart Glennie divides the study of man's history into that of folk-life and of culture-life. The classification of folk-lore is identical with the psychological elements of folk-life, corresponding (A) with the most general facts of human consciousness: (1) An external world, (2) other beings, (3) an ancestral world; (B) and with the most general facts of human faculty: (1) Imagination, (2) affection, (3) memory. Corresponding with these facts of consciousness and of faculty, the three psychological elements of folk-life are (1) folk-beliefs, (2) folk-passions, (3) folk-traditions; and the expression of these are to be found in (1) customs, (2) sayings, (3) poesy. Folk-customs, as expressive of folk-life, may be more especially expressive of folk-beliefs, or of folk-passions, or of folk-traditions; and hence folk-customs may be classified as (1) festivals, (2) ceremonies, (3) usages (religious, sexual and social). Folk-sayings may be classified as (1) recipes (magical, medical and technical); (2) saws (proverbs, tests, riddles) (3), forecasts (omens, weather signs and auguries). Folk-poesy may be classified as (1) stories, (2) songs (mythological, affectional and historical), and (3) sagas.

ELEMENTS OF FOLK-LIFE AND SUBJECTS OF FOLK-LORE.

I. Folk-beliefs. II. Folk-passions. III. Folk-traditions.

THE EXPRESSIONS OF FOLK-LIFE AND RECORDS OF FOLK-LORE.

I. *Folk-customs:*	II. *Folk-sayings:*	III. *Folk-poesy:*
1. Festivals. (1) Religious. (2) Sexual. (3) Social.	1. Recipes. (1) Magical. (2) Medical. (3) Technical.	1. Stories.
2. Ceremonies (1) Religious. (2) Sexual. (3) Social.	2. Saws. (1) Proverbs. (2) Tests. (3) Riddles.	2. Songs. (1) Mythological. (2) Affectional. (3) Historical.
3. Usages. (1) Religious. (2) Sexual. (3) Social.	3. Forecasts. (1) Omens. (2) Auguries. (3) Weather-signs.	3. Sagas. Folk-music. (1) Meters. (2) Melodies. (3) Instruments.

We are not prepared to accept Mr. Glennie's dictum that folk-lore is our lore about the folk, for that would really be culture-

lore, according to his own definition. Several of the gentlemen have wisely started their study with the two inquiries, who are the folk, and what is lore? Señor Alvarez remarks, "The word *folk*, German *volk*, Latin *vulgus*, Italian *volgo*, Spanish *vulgo*, signifies not the whole of humanity, but a portion of the human race, who possess a series of common signs, and are really anonymous in contradistinction from that other series of men who possess a notable personality." He would include practically all savages and the untutored herd of civilized society.

It is very certain that what constitutes the knowings, the sayings and the ways or wonts of the untutored, the unthinking and the unprogressive among us remind us much of savagery. It is also very certain that each age of the world, each gradus of society resembles the geological ages; that is, each one, in addition to all that it has added of new embraces, includes much of all the antecedent ages, grades or epochs. The folk-lorists are, therefore, altogether scientific in collecting the lore of savages *en masse*, the lore of barbaric and civilized peoples, so far as they are *survivals* of times not their own.

Practically, therefore, what do the folk-lorists wish us to collect, and how shall we name and classify our material after it is gathered? Just at this writing we are inclined to use Miss Burne's modification of Mr. Gomme's scheme.

For the filing of tales the folk-lore society has adopted a scheme, with printed headings, as follows:

1. Generic name of story (not to be filled up).
2. Specific name.
3. Dramatis personæ.
4. Thread of story.
5. Incidental circumstances.
6. Where published.
7. Nature of collection. (1) Original or translation.
   (2) If oral, state narrator's name.
   (3) Other particulars.
8. Special points noted by the editor of the above.

(Signed) _____.

ARROW RELEASE.—This term applies to the actions of an archer in discharging the arrow from a bow. To this topic Professor E. S. Morse has given more attention than any one else, and has published thereon a monograph in the Bulletin of the Essex Institute (XVII, 1885) on purpose to secure further material for a more extended memoir on the subject. The readers of this journal who have noted the methods of arrow release in any part of the world should send their information to Professor Morse, in Salem.

As an example of diversity in these matters, Professor Morse says: In the English practice the bow must be grasped firmly;

in the Japanese, loosely. In both cases it is held vertically, but in the English method the arrow rests on the left of the bow, while in the Japanese it is placed on the right. The English wristguard is worn on the inner and lower part of the arm; the Japanese need none, as they fling the bow half round at the moment of release. The English archer grasps his bow in the middle; the Japanese near its lower third. In the English method the string is drawn with the tips of the first three fingers; in the Japanese the string is drawn back by the bent thumb.

The methods of release characterized are as follows:

1. *Primary.*—The nock of the arrow is grasped between the end of the straightened thumb and the first and second joints of the bent forefinger. It is practiced by children universally, and by the Ainos, Demeraras, Utes, Navajos, Chippewas, Micmacs, Penobscots.

2. *Secondary.*—The nock of the arrow is grasped with the straightened thumb and bent forefinger, while the ends of the second and third fingers are brought to bear on the string to assist in drawing. It is practiced by Zuñis, Chippewas of Wisconsin, Ottowas.

3. *Tertiary.*—In this release the forefinger, instead of being bent, is nearly straight, with its tip, as well as the tips of the second and third fingers, pressing or pulling on the string, the thumb, as in the primary and secondary release, active in assisting in pinching the arrow and pulling it back. It is practiced by Sioux, Arapahos, Cheyennes, Assiniboins, Comanches, Crows, Blackfeet, Navajos, Siamese, Great Andamanese.

4. *Mediterranean.*—The string is drawn back with the tips of the first, second and third fingers, the balls of the fingers clinging to the string, with the terminal joints of the fingers slightly flexed. The arrow is lightly held between the first and second fingers, the thumb straight and inactive. Practiced by nations around the Mediterranean by modern archers, Flemish (using first and second finger only), Eskimos, Little Andamanese.

5. *Mongolian.*—In this release the string is drawn by the flexed thumb bent over the string, the end of the forefinger assisting in holding the thumb in position. The thumb is protected by a guard of some kind. It is practiced by Manchus, Chinese, Koreans, Japanese, Turks, Persians.

The latter half of Professor Morse's pamphlet is devoted to the examination of ancient monuments, etc., in order to ascertain the methods of release practiced in Assyria, Egypt, Greece and other states. This portion of the paper has yielded to the author results by no means commensurate with his pains, because the ancient sculptors were not aware that their accuracy would be scrutinized thousands of years hence.

THE ORIGIN OF LANGUAGES.—The vice-presidential address of the Hon. Horatio Hale before Section H of the American Association at Buffalo was upon the origin of languages and the antiquity of speaking man. It contains views so original and novel that it is eminently proper to present a condensed scheme of the argument.

1. Among the puzzling questions in anthropology which we are bound to notice are these two: When did linguistic stocks originate? When did man acquire the faculty of speech? It will be seen that the origin of languages and the origin of language are two very different questions.

Mr. Hale, rejecting the old theories which rely upon time, the dispersion of a monosyllabic parent stock, the dispersion of speechless man and the origination of languages in different centers, avers that the origin of linguistic stocks is to be found in what may be called the language-making instincts of very young children. To insure the creation of a speech which shall be the parent of a new linguistic stock, all that is needed is that two or more young children should be placed by themselves in a condition where they will be entirely, or in a large degree, free from the presence and influence of their elders, and that they should continue in this condition long enough to grow up, to form a household, and to have descendants to whom they can communicate their new speech. This theory is elaborated with great care and the multiplicity of stocks in California made by a camping-ground of the argument.

The second part of the argument is also accompanied with the revival of startling doctrines, namely, that while the antiquity of man is incalculable the speaking man is of recent origin, having occupied this planet at most not over ten thousand years. "If we are willing to give the name of man to a half brutish being, incapable of speech, we must allow to this being an existence of vast and as yet undefined duration, shared with the mammoth, the woolly rhinoceros, and other extinct animals. But if we term the beings of that race the precursors of man, and restrict the name of men to the members of the speaking race that followed them, then the first appearance of man, properly so styled, must be dated at about six thousand or ten thousand years ago. And this man who thus appeared was not a being of feeble powers, a dull-witted savage. He possessed and manifested from the first intellectual faculties—intellectual faculties of the highest order—such as none of his descendants have surpassed. His speech, we may be sure, was not a mere mumble of disjointed sounds; it was a full, expressive, well-organized speech, complete in all its parts. The first men spoke because they possessed along with the vocal organs the cerebral faculty of speech; "that faculty was an instinct of the mind, as irresistible as any other instinct."

SCIENTIFIC NEWS.[1]

— The French Association for the Advancement of Science held its session this year at Nancy. Thirty-two savans contributed papers upon engineering and mathematics, forty-four upon physics and chemistry, fifty-eight upon the natural sciences, and fifty-nine on economics, some contributing several papers. The Revue Scientifique (Aug. 14) prints in full the address of the president, M. Friedel, upon the progress of chemistry and mineralogy; that of M. E. Collignon, secretary, upon the history of the association during the year; that of M. A. Volland, mayor of Nancy, and that of M. E. Galante, treasurer, upon the finances of the association. From the first of these discourses it appears that spinel, corundum, and rubies have been manufactured artificially, and that the false rubies are not infrequent in the market. The last meeting, held at Grenoble, received a total of 342 communications, 166 of which were upon the natural sciences. Fourteen members were lost by death during the year, including MM. Bouquet, Bouley, Jamin, Robin and Dechambre. The number of associates is kept up to three thousand eight hundred.

Among the papers read in the natural history section were those of M. Cartailhac, on sepulchres of the stone age, etc.; of M. Chatin, on the flora of Paris and Dauphiné; of F. Lataste, on the dentary system of Hyrax; of Manouvrier, on the delimitation of anthropology; of Mortillet, on criminal anthropology, and of Testut, on "microcéphales." A number of distinguished foreigners were present at the meeting. M. Cartailhac drew attention to the prevalence of burial after decomposition of the soft parts. In the reindeer age this was usual. In Spain the body of the late king lies in "el putrido" until the death of his successor. An interesting discussion on wheat production took place in the agricultural section. The wheat growers of Europe regard with anxiety the increase of the wheat production of Hindostan. Some interesting excursions were taken, one to a spot upon German soil was frustrated by the ignorant fussiness of the local German authorities. The next meeting of the association will be held at Toulouse, that of 1888 at Oran, Algeria.

— The new Gogebic Iron range is located parallel with the shore of Lake Superior and about forty miles distant, equi-exposed in Michigan and Wisconsin. There are two veins running very near to each other that average 25 to 160 feet in width and are of unknown depth. The ore is all within the Bessemer limit, varying about five per cent at the surface but assuming an equality below. The veins head nearly south at an angle of thirty degrees from the perpendicular. The quality averages sixty-seven per cent pure hematite and is soft and crumbling. The opening of the range

[1] Edited by WM. HOSEA BALLOU, 265 Broadway, New York.

has caused an unprecedented migration, 15,000 settlers having located there during fifteen months. The range has been exposed for nearly sixty miles, cropping out on the surface of the mountains and disappearing to 250 feet below in the valleys. The depth of the ore in the valleys is explained by its soft texture, the water having swept it away, after which soil filled in and covered it.

— Messrs. J. B. Lippincott Company have in press a "Manual of North American Birds," by the eminent ornithologist, Professor Robert Ridgway, curator, Department of Birds, Smithsonian Institution, Washington, D. C. The work is to contain some 435 illustrations suitably executed, and will conform to the geographical limits, classification, numeration and nomenclature adopted by the American Ornithological Union. We doubt not it will be one of the most important, thorough and original contributions to the literature of the subject which has ever appeared, and presume that naturalists and sportsmen alike will find in it an invaluable aid.

— The output of the iron ore mines of the Lake Superior region will be about 3,000 000 tons for the season of 1886, or one-third larger than in any other past year.

——:o:——

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

AMERICAN PHILOSOPHICAL SOCIETY, Dec. 18, 1885.—Professor Cope presented for the Transactions "A Chemical Study of *Yucca angustifolia*" by Miss H. C. de S. Abbott.

Jan. 1, 1886.—Professor Allen made a communication on the result of experiments on electric light used in photographing animals in motion.

Professor Cope presented a paper on the Intercentrum of the Terrestrial Vertebrata; also another by Dr. Alfredo Dugés, of Guanajuato, entitled "Sur le *Rhinocheilus antonii*.

Jan. 15.—Mr. Lesley read a paper on the evident Bedouin origin of the *Shedi* deity in the Hebrew Scriptures, commonly translated "the Almighty." He drew the conclusion that it bore a manifest relationship to the deity *Seti* introduced into Egypt and Palestine from Arabia.

Mr. Lesley also communicated a revision of the section of the Le Roy (Chemung) beds in Bradford county, giving additions to the list of its fossils, and extending it downward nearly 350 feet, to include a rich horizon.

Mr. Ashburner made a communication showing the course of the barometer during the storm of Jan. 8th.

Dr. Persifor Frazer spoke upon the application of composite photography to handwriting.

Dr. H. Allen exhibited an example of *Chlamydophorus truncatus*.

Feb. 5.—Professor Cope presented a paper on the structure and affinities of Amphiuma.

A paper from Dr. Hoffman on Indian tribal names, and another, by Professor A. S. Packard, on the discovery of thoracic feet in a carboniferous Phyllocarida, were presented for publication.

Dr. Horn exhibited sketches and anatomical details of Chrysobothris.

Feb. 19.—A paper from Professor S. C. Branner, entitled "The glaciation of the Wyoming and Lackawanna valleys," was presented.

Professor Cope presented a paper on two new species of three-toed horses from the Upper Miocene, with notes on the fauna of the Ticholeptus beds.

March 19.—Dr. Brinton presented two papers by Dr. W. S. Hoffman, one on the Selish language, and another on the Waitshumni dialect.

Dr. Horn explained the process among the Piutes of sweetening acorn meal by percolation with water, so as to render the product edible.

Lieut. Wyckoff made a verbal communication on the action of heavy vegetable or fish oils in reducing heavy combing waves to long swells.

PHILADELPHIA ACADEMY OF NATURAL SCIENCES, July 1, 1886.—Dr. Horn exhibited a pair of a species of beetle the female of which had before been unknown. The female never passed the larval condition, and had been described as the larva of an insect of another family. It is among Coleoptera the only known case of a fertile larval female. The female grub is two inches long, and its segments emit a green phosphorescence along their margins. The specimen had been sent from S. Carolina. An allied form occurs in California.

Dr. Leidy described a number of parasitic worms from the rabbit, meadow-lark, etc., etc.

Dr. G. A. Kœnig placed on record the identification of Stromeyerite from Zacatecas. The Mexicans call it "plata azul." It consists of one molecule of sulphide of silver to one of sulphide of copper. Quartz is the usual gangue of this mineral.

Aug. 5.—Dr. Horn showed a fragment of the palm *Washingtonia filifera* containing a larva of a beetle (Dinapate) recently described by him.

Mr. L. Woolman recorded the discovery by him of a belt of Oriskany sandstone near Pennsville, Lycoming county, Pa. This belt is unmarked in the surveys. The stone was used for building, and contained *Spirifer arenoides*, *S. arrectus* and *Rensellaria ovoides*.

J. C. Arthur, of Geneva, New York, presented a paper on the history and biology of the pear blight.